

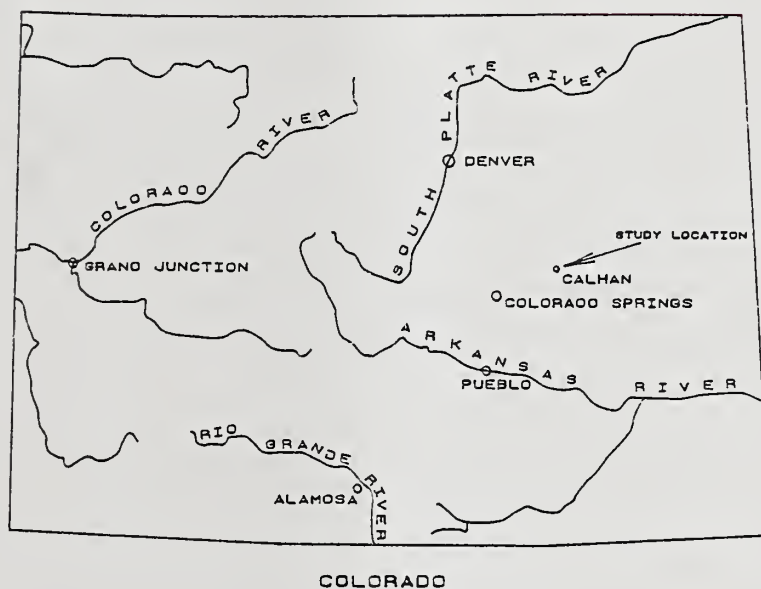
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UNITED STATES
DEPARTMENT OF
AGRICULTURE
NATURAL RESOURCES
CONSERVATION SERVICE
KEWOOD - COLORADO

FLOOD PLAIN MANAGEMENT STUDY TOWN OF CALHAN EL PASO COUNTY, COLORADO



AUGUST, 1995

**United States
Department of
Agriculture**



National Agricultural Library

FLOOD PLAIN MANAGEMENT STUDY

**TOWN OF CALHAN
IN
EL PASO COUNTY, COLORADO**

**Prepared by the
U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
Lakewood, Colorado
in cooperation with the
Colorado Water Conservation Board
El Paso County and the Town of Calhan**

August, 1995

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PREFACE

This report includes information on the flood hazard areas in the Town of Calhan, Colorado.

Because of the potential for flood damages, detailed flood hazard studies have been recognized as an essential item in guiding the use of flood plains. The purpose of this report is to provide adequate mapping and data for implementing flood plain management programs.

Rapid development is occurring in the Town of Calhan as a result of population growth and economic expansion. The only flood plain information currently available is an approximate map prepared by the Federal Emergency Management Agency (FEMA). This map has been supplemented with additional flow data prepared by the Colorado Water Conservation Board. The available flood plain information is not suitable for guiding development and preventing structures from being built in the flood plain. Discussions with local residents, review of historic information, and field visits all indicate the present flood plains shown on the Flood Insurance Rate Map (FIRM) are quite inaccurate and this map needs update with a flood plain study.

Included in this report are information on past floods, the potential for future floods, flooded area maps, water surface profiles, selected cross sections, peak discharge data, and recommendations for reducing potential flood damages.

The Natural Resources Conservation Service (formerly Soil Conservation Service) conducted the technical studies and prepared the report. These services were carried out in accordance with the Plan of Work of December, 1992.

The assistance and cooperation provided by the Colorado Water Conservation Board, El Paso County, and the Town of Calhan are appreciated and gratefully acknowledged.

The field surveys, hydrologic, hydraulic, and other pertinent data and computations are on file with U.S. Department of Agriculture, Natural Resources Conservation Service, 655 Parfet Street, Lakewood, Colorado 80215-5517, telephone (303) 236-2900. Additional copies of this report may be obtained from the Natural Resources Conservation Service.

CIVIL RIGHTS AND CULTURAL RESOURCES IMPACT ANALYSES

I. CIVIL RIGHTS IMPACT ANALYSIS

A. Civil Rights Compliance

The program or activities conducted under this agreement will be in compliance with the nondiscrimination provision as contained in Titles VI and VII of the Civil Rights Act of 1964, as amended, the Civil Rights Restoration Act of 1987 (Public Law 100-259), and other nondiscrimination statutes, namely, section 504 of the Rehabilitation Act of 1972, and the Age Discrimination Act of 1975. They will also be in accordance with regulations of the Secretary of Agriculture (7 CFR-15, Subparts A and B), which provide that no person in the United States shall, on the grounds of race, color, national origin, age, sex, religion, marital status, or handicap, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the Department of Agriculture or any agency thereof.

B. Demography of Study Area

According to a survey, which was done July of 1995, the Town of Calhan has a total population of 703 people. Most of these residents work in a near by City of Colorado Springs. Their median annual income is somewhere in between \$15,000 to \$18,000. The constituents of the protected groups are as follows:

<u>Protected Groups:</u>	<u>Persons</u>	<u>Percent of Population</u>
Hispanics	57	8.1 %
African-American	4	0.6 %
Asian/Pacific	2	0.3 %
Physically Challenged	333 (*)	47.4 %
Female	323	46.0 %

C. Property Values

The values of the homes and trailers located along the study reaches varied from \$80,000 to \$150,000 and from \$15,000 to \$35,000 respectively.

D. Impact Analysis

This flood plain management study has no negative impact on the protected groups. It only helps them in protecting their lives and preventing losses of their personal properties which may result in an event of flooding.

II. CULTURAL IMPACT ANALYSIS

The Calhan's Flood Plain Management Study does not impact cultural resources or affect historic properties. In accordance to NRCS GM 420 Part 401.3a1 this project assistance is not considered an undertaking. However, if any actions are taken that could have any adverse effects on a site, the action will stop until applicable provisions of Public Law 93-291 and/or Public Law 89-665 have been complied with. Applicable state laws dealing with archaeological and historic site preservation will also be complied with.

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INTRODUCTION

This flood plain management report was prepared by the U.S. Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Colorado Water Conservation Board, El Paso County, and the Town of Calhan, Colorado. Interpretations of the flood plain management study and recommendations to reduce damages are included; however it is beyond the scope of this report to provide detailed proposals or plans to rectify the flooding problems.

A. Objectives

The objective of this study is to provide detailed flood plain management information and mapping to the El Paso County and Town of Calhan for use in implementing flood plain management programs which will minimize potential flood damages. Included in the report are engineering and hydrologic data which will facilitate the development of a flood plain management plan, road and bridge designs, and flood control measures (if needed).

B. Authority

Section 37-60-106(1)(c), Colorado Revised Statutes, authorizes the Colorado Water Conservation Board "to designate and approve storm or floodwater runoff channels or basins, and to make such designations available to legislative bodies of cities and incorporated towns, to county planning commissions, and to boards of adjustment of cities, incorporated towns, and counties of this state". The board provides assistance to local governments in development and adoption of effective floodplain ordinances. In addition, the board will provide technical assistance to local entities during the performance of floodplain information studies within Colorado. Presently, direct financial assistance for the performance of floodplain studies is no longer available from the board.

Section 30-28-111 C.R.S. for county governments and Section 1-23-301 C.R.S. for municipal governments of the Colorado Revised Statutes state the cities, incorporated towns, and counties within the study area may provide zoning regulations "... To establish, regulate, restrict, and limit such uses on or along any storm or floodwater runoff channel or basin that has been designated and approved by the Colorado Water Conservation Board, in order to lessen or avoid the hazards to persons and damage to property resulting from the accumulation of storm or floodwaters ..."

Therefore, upon official approval of this report by the Colorado Water Conservation Board, the areas described as being inundated by the 100-year flood can be designated as flood hazard areas and their use regulated accordingly by the local governments.

Flood plain management studies are carried out by the Natural Resources Conservation Service as an outgrowth of the recommendations in A Report by the Task Force on Federal Flood Control Policy, House Document No. 465 (89th Congress, August 10, 1966), especially Recommendation 9(c), Regulation of Land Use, which recommended the preparation of preliminary reports for guidance in those areas where assistance is needed before a full flood plain information report can be prepared or where a full report is not scheduled.

Authority for funding flood plain management studies is provided by Section 6 of Public Law 83-566, which authorizes the U.S. Department of Agriculture to cooperate with other federal, state and local agencies to make investigations and surveys of the watersheds and rivers and other waterways as a basis for the development of coordinated programs. In carrying out flood plain management studies, the Natural Resources Conservation Service is being responsive to Executive Order 11988, entitled "Flood Plain Management", and Executive Order 11990, entitled "Protection of Wetlands" (both effective May 24, 1977).

DESCRIPTION OF STUDY AREA

A. Basin Characteristics

The watersheds that produce runoff in Calhan are relatively small in size (total area: 3.0 sq. miles). Elevations range from 6950 ft at the upper reaches of the watersheds to 6500 ft at the northern boundary of the Town of Calhan. Slopes range from 4 percent to 6 percent.

The soils in the basin, along the stream channels, are of hydrologic groups B and C. They are moderately deep to deep, well drained soil formed in mixed alluvium and wind-laid materials derived from arkosic and calcareous sedimentary rocks.

The vegetation in the watersheds is predominantly native range in fair to poor condition. There is approximately one quarter of the lower basin which is occupied by residential and commercial properties. Most of these properties are located in the northeast corner of the lower basin.

The flood plains, within the study limits, generally contain typical residential and commercial property improvements such as buildings, yards, fences, streets, vehicles, etc. Vegetation such as lawns, shrubs, trees, flowers, and forbes are a part of the landscape. There are some willows and cottonwoods along those channels that have a sustained water supply. The channel does a considerable amount of meandering which enhances the visual aesthetics and wildlife habitat values in the area.

The mean annual precipitation for the basin ranges from 16 to 20 inches. There is no precipitation record for the Town of Calhan. A climate station in Eastonville, a town which is 15 miles due west of Calhan, has a mean annual precipitation of 17.38 inches with July and August accounting for the greatest monthly values (2.78 in. each month). Snowfall does occur throughout the winter period however there is no large accumulation. An analysis into the contribution of spring snowmelt to flooding suggests it is not a significant factor. Late Spring and Summer rains are the most likely to produce flooding in the study area.

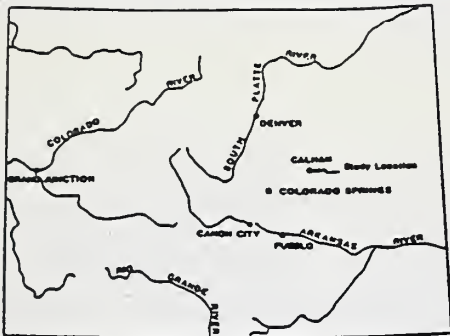
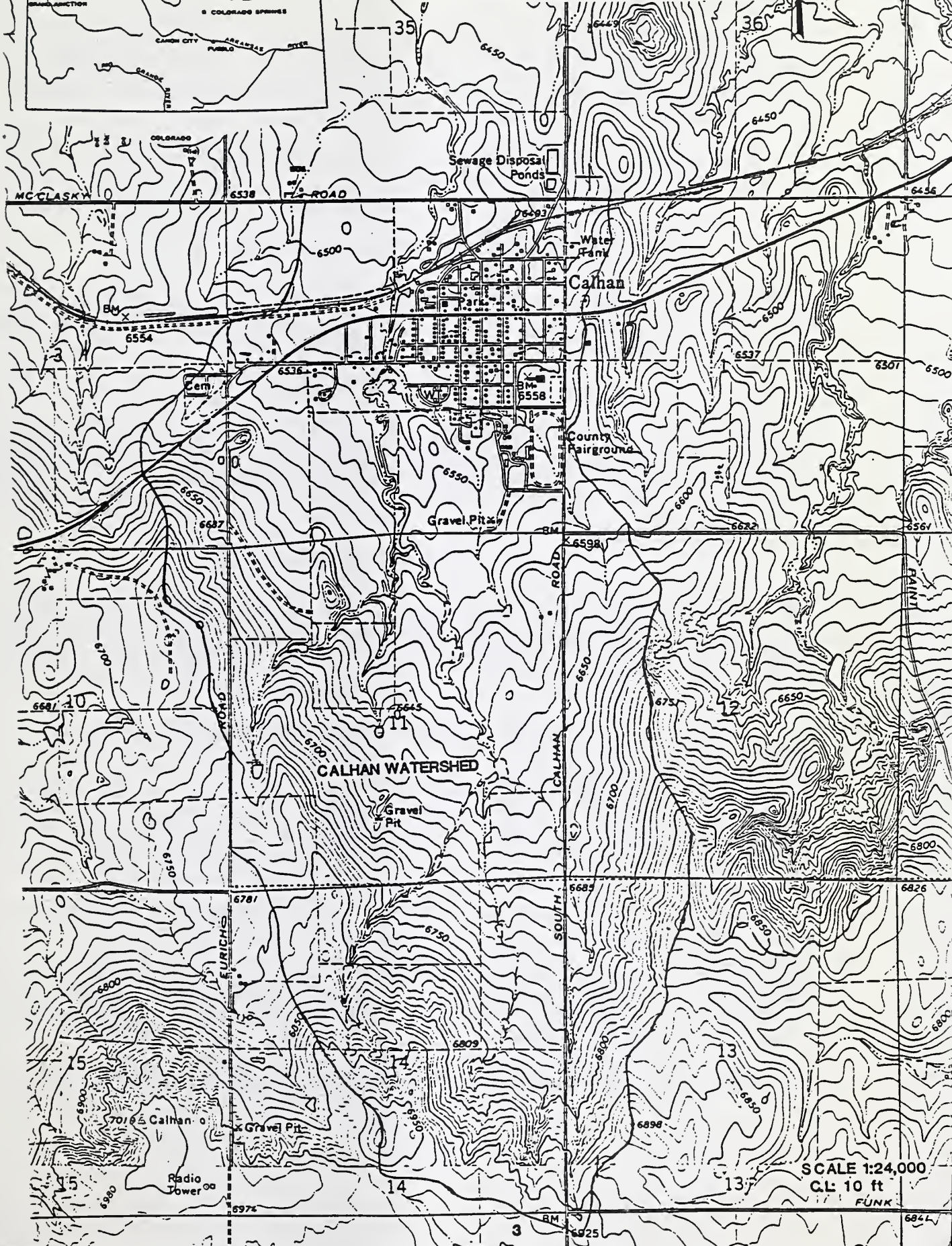


FIGURE 1 - WATERSHED MAP
CALHAN FLOOD PLAIN MANAGEMENT STUDY



SCALE 1:24,000
C.I. 10 ft
FUNK

B. Study Limits

The study includes all of the drainage ways within and adjacent to the corporate limits of the Town of Calhan. The study areas will extend from the southern border of Section 2, T12S, R62W to approximately 50 ft from the downstream side of McClasky Road. This includes the following reaches:

<u>Reach</u>	<u>Length</u>
Main Tributary	0.80 Miles
East Tributary	0.40 "
<u>Fairground Tributary</u>	<u>0.30 Miles</u>
Total Reach Length :	1.50 Miles

An index map showing the location of flood plain mapping is included as figure 2. The flood plain maps themselves are shown as sheets 1 through 2 following the index map.

RELATED FLOOD STUDIES

No detailed flood studies have been made previously for this study location. The Federal Emergency Management Agency, and Colorado Water Conservation Board prepared an approximate flood plain map to serve as intermediate guidelines until this more detailed data was completed.

FLOOD HISTORY

No significant flooding had ever occurred in the Town of Calhan. According to one local town resident, whose home is located by the Eight Street bridge, the highest flow that he had ever witnessed since 1965, came within 3 to 4 feet of the bridge's bottom rung and this flow did not breach the channel banks.

INVESTIGATIONS AND ANALYSIS

A. Interpretation and Use of Report

1. **Frequency and Discharge:** The 10-, 25-, 50-, 100-, and 500-year flood events are used as the flood frequencies for this flood plain analysis. Thus, the data developed in this report will be suitable not only for regulation purposes, and H.B. 1041 designation but is also consistent with Federal Insurance Administration flood insurance studies conducted by the Federal Emergency Management Agency.

These various flood events have an average occurrence of once in the number of years as indicated. For example, the 100-year flood occurs, on the average, once in a 100-year period, and has a one percent chance of being equaled or exceeded in any given year.

The particular uses for the various flood events in addition to

those stated above are as follows:

10-year, 25-year and 50-year Flood Events

Information regarding these lower frequency floods is especially useful for future engineering studies and land use planning purposes related to minor road systems, minor channel improvements, the location of parks and recreational facilities, agricultural lands, and appurtenant structures. The use of the lower frequency floods may be considered in planning flood prevention projects to protect agricultural areas, or other property where risk to life is not a factor.

100-year Flood Event

The 100-year flood event may be used in lieu of lower frequencies for engineering design purposes where greater security from structure failure is desired.

However, the most important use of the 100-year flood event lies in flood plain management and land use planning as set forth in the state statutes. The State of Colorado and the Federal Government consider the 100-year frequency flood as the flood event to be used in designing and protecting structures and dwellings for human occupation. Therefore, all flood plain regulations are based upon the 100-year flood.

500-year Flood Event

The 500-year flood event may be used to show the upper level of flood plain management, or for a certain critical type of construction such as one that involves water or sewage treatment plant, the 500-year flood event can be used to provide an upper level of safety.

2. Flood Elevation: Water surface elevations for the 10-, 25-, 50-, 100-year and 500-year floods, as determined at each cross section, may be found in Table 1 "Flood Frequency-Elevation and Discharge Data". The flood profile data (sheets 1P through 15P) show a graphical relationship of water surface elevations along the stream reaches for the given frequencies. Selected typical cross sections from different reaches within the study area are shown on sheets 1X and 2X.

The flood profiles may be used in areas where controversy arises over the 100-year flood boundary shown on the Flood Plain Maps. Since the flood profile exhibits give the water surface elevation at a specific point on the reference line, the flood elevations can be surveyed on the ground to alleviate any discrepancies on the base map.

3. Flooded Areas: Flood plain maps, sheets 1 and 2, show the boundaries of the 100-year and 500-year flood plains. The flood

plain boundaries were plotted using flood contour elevations and stationing from the plotted flood profiles. This was done at elevation intervals compatible with the map contour intervals. Flood contours are shown as wiggly lines at 2-ft intervals perpendicular to the direction of flow.

B. Hydrology

The watersheds that produce runoff to channels in and around Calhan are relatively small in size. They are mostly range land in fair condition and consist of several old terraces. The retarding effect of these terraces on the rainfall runoff was not considered due to their poor condition. Ponding and storage effects also were not considered for the small ponds in the watersheds because those ponds were not built for flood control.

Snowmelt was not a contributing factor to runoff frequencies of 10-year or greater, which are the primary concern of this study. This implies that significant runoff is coming from rainfall events. As a consequence, only rainfall generated runoff was considered in developing peak discharge-frequency values included herein.

The NOAA Atlas for Colorado was used as the source for 24-hour rainfall depths. Historical station precipitation data was considered, but it was not adequate to be analyzed as a possible alternative to using NOAA data. No aerial adjustments were made because of the small drainage areas involved. The NRCS 24-hr Type IIA rainfall distribution, instead of the Type II distribution, was used because the Type IIA was more representative of the rainfall pattern in the area. A shorter rainfall duration (2-hr) and its associated rainfall depths also were used in the Natural Resources Conservation Service's (NRCS) TR-20 hydrologic program model. This 2-hr rainfall actually yielded less runoffs than the standard SCS 24-hr Type IIA rainfall distribution. The NRCS Type IIA rainfall distribution was selected for use in the TR-20 computer model to generate peak frequency discharges. These values are listed in Table 1.

Hydrologic runoff curve numbers (CN's) were developed from the NRCS soil map, land use information, and field observations. CN values for the TR-20 watersheds reflect weighted average CN's for a variety of land uses and soils within each watershed.

Time of concentration values were computed by the method described in the Natural Resources Conservation Service Technical Release 55 (Urban Hydrology for Small Watersheds). Another method from the NRCS Engineering Field Manual - Chapter 2, intended for small rural watersheds, was also considered, but the TR-55 was favored in estimating the Tc's.

C. Hydraulics

Hydraulic analyses conducted in this study were done using the

U.S. Army Corps of Engineers computer model HEC-2 Water Surface Profiles. The average watershed slope in the study reach is 4 percent to 6 percent; therefore supercritical flow conditions prevail through all study reaches.

Discharge values were discussed in the hydrology section of this report. All of the cross section data were handpicked from topographic maps with a scale of 1 inch = 200 ft and contour interval of 2 feet. Dimensions of bridges and hydraulic roughness coefficients (n-values) were determined from field investigations.

Water surface profiles, typical cross sections, and maps showing the 100-year and 500-yr flood boundaries are shown on included exhibits and flood plain maps. Table 1 shows computed flood elevations at specific cross sections.

Flood boundaries were located on the set of topographic maps, previously referred to, by transferring flood elevations (at map contour intervals) from plotted profiles (from HEC-2) to the maps using stationing along the main channel as the location reference. These points were connected and smoothed to create the map flood boundaries.

FLOOD PLAIN MANAGEMENT

Potential flood damages to existing development and possible loss of life can be alleviated or lessened through non-structural and structural flood hazard mitigation methods.

Non-structural methods include: Local flood plain regulations, land treatment, flood warning and forecasting systems, flood insurance, flood proofing, flood fighting and emergency evacuations.

A. Local Regulations

The need to minimize property damage due to flooding has been recognized by planners and local community officials. Subdividers and developers are required to submit proposed storm drainage plans to the planning commission for approval. In the past, drainage plans have been prepared singularly or on a plat-by-plat basis. Information contained in this report will be useful in developing a master drainage plan for the study area. This report provides the outline of flood hazard areas on large scale maps specifically for this purpose.

The City may provide zoning regulations "... To establish, regulate, restrict, and limit such uses on or along any storm or floodwater runoff channel or basin, as such storm or floodwater runoff channel or basin has been designated and approved by the Colorado Water Conservation Board, in order to lessen or avoid the hazards to persons and damage to property resulting from the accumulation of storm of floodwaters..." as stated in Section 30-

28-111 for county governments and Sections 31-23-302 for municipal governments of the Colorado Revised Statutes.

B. Colorado Natural Hazard Area Regulations

In 1974, the Colorado General Assembly passed House Bill 1041, a bill "concerning land use, and providing for identification, designation, and administration of areas and activities of State interest,..." (H.B. 1041, Title 24, Article 65.1, C.R.S., as amended). Areas of State interest include natural hazard areas, or those areas that are "so adverse to past, current, or foreseeable construction or land use as to constitute a significant hazard to public health and safety or to property". Flood plains are natural hazard areas.

With reference to the administration of natural hazard areas, Section 24-65.1-202(2)(a) of the Act provides: Flood plains shall be administered so as to minimize significant hazard to public health and safety or to property; open space activities shall be encouraged; structures shall be designed in terms of use and hazards; disposal sites and systems shall be discouraged which, in time of flooding, would create significant hazards to public health and safety or to property.

The Act further provides that after promulgation of guidelines for land use in natural hazard areas..., the natural hazard areas shall be administered by local government in a manner which is consistent with the guidelines for land use in each of the natural hazard areas.

C. Colorado Water Conservation Board Designation

Concerning the designation of the flood plain, the Colorado Water Conservation Board is charged with the primary responsibility for:

1. Making recommendation to local governments and the Colorado Land-Use Commission.
2. Providing technical assistance to local governments.

The Board's power and duty is...

"... To devise and formulate methods, means and plans for bringing about the greater utilization of the waters of the State and prevention of flood damages therefrom, and to designate and approve storm or floodwater runoff channels or basins, and to make such designations available to legislative bodies of cities and incorporated towns, to county planning commissions, and to boards of adjustment of cities, incorporated town, and counties of this state".

As stated in Section 37-60-106(1)(c) of the Colorado Revised Statutes.

Upon review and approval of this report, the Colorado Water

Conservation Board will designate and approve as flood plain areas those areas inundated by the 100-year flood as described by the floodwater surface elevations and profiles in this report. The use of the designated flood plain areas may then be regulated by the local government.

D. Model Regulations

Model flood plain regulations have been promulgated by the Colorado Water Conservation Board, with the purpose to promote public health, safety, and general welfare, and minimize flood hazards and losses. The model includes provisions designed to:

1. Promote sound planning and permit only such uses within flood plains that will not endanger life, health, and public safety or property in times of flooding.
2. Protect the public from avoidable financial expenditures for flood control projects, flood relief measures, and the repair and restoration of damaged public facilities.
3. Prevent avoidable interruption of business and commerce.
4. Minimize victimization of unwary home and land purchases.
5. Facilitate the administration of flood hazard areas by establishing requirements that must be met before use or development is permitted.

The Board's model flood plain regulations offer two options for management of the 100-year flood plain. These are the Hazard Area Concept and the Floodway Concept.

The Hazard Area Concept defines the areas of the flood plain in which waters of the 100-year flood attain a maximum depth greater than one and one-half feet as high as a high hazard area, and a depth less than this as a low hazard area.

The Floodway Concept defines the channel of a stream and adjacent flood plain areas that must be kept free of development in order to safely pass the 100-year flood with a minimal rise in the water surface elevation. The rise must be no more than one foot to meet the federal standards.

E. Flood Insurance

The National Flood Insurance Act of 1968 (Title XIII of the Housing and Urban Development Act, P.L. 90-448) recognized the necessity for flood plain management. This Act makes federally subsidized insurance available to citizens in communities that adopt regulations controlling future developments of their flood plain. With respect to encroachment on the flood plain, the regulations require:

1. New residential construction or substantial improvement of existing homes must have the lowest floor level at or above the elevation of the 100-year flood.
2. Non-residential construction must meet the same standard or be flood proofed to that level.

The 1968 Act benefits owners of structures already in the flood-prone areas by providing insurance coverage that had been unavailable through private companies. The Act created a cooperative program of insurance against flood damage by the private flood insurance industry and the federal government.

The amount of coverage available and the premium rate varies considerably depending on property location within the flood plain and the property value. All property owners shown in this study to be within areas subject to flooding should consider the purchase of flood insurance.

Additional information on the Flood Insurance Program is available from local insurance agents/brokers or FEMA by writing to:

Federal Emergency Management Agency, Region VIII
Natural and Technological Hazard Division
Denver Federal Center, Building 710
Denver, CO 80225
Telephone: 235-4830

The National Flood Insurance Program used the Floodway Concept in its rate studies for communities participating in the regular phase of the program.

F. Flood Warning and Flood Forecasting System

The National Oceanic and Atmospheric Administration (NOAA) through its National Weather Service Agency (NWS), maintains year-round surveillance of weather and flood conditions. Daily weather forecasts are issued through the NWS and disseminated by radio and television stations. A general alert to the danger of flash flooding is one of the service provided by the NWS.

The Office of the Colorado State Engineer, Division of Water Resources, in cooperation with the National Weather Service, operates a state-wide flood warning system utilizing 78 stream gaging stations that are part of the Colorado satellite-linked water resources monitoring network operated by the State Engineer.

G. Evacuation Plan

An "Emergency Evacuation and Operations Plan" would provide for alerting the public of potential flooding, and coordinating community and county services during an emergency. Planning implementation during the time of an emergency requires cooperation of the general public as well as local officials.

This is especially important for flood fighting, evacuation, and rescue operations. Communication is extremely important during flood alerts. Warnings issued through the NWS are disseminated by radio to state and local officials.

RECOMMENDATIONS

The following recommendations are included for consideration in reducing potential flood damages:

1. Carry out periodic maintenance of bridges and culverts to preserve their hydraulic capacity.
2. Do detailed study of need for flood proofing around facilities in the flood plain or consider flood insurance.
3. Information and education programs on flood hazards should be made available to the public.
4. The main channels should be maintained to preserve a balance between native vegetation, conveyance capacity, channel stability, and provide wildlife habitat.

In compliance with Section 404 of the Clean Water Act, administered by the U.S. Army Corps of Engineers, it is the responsibility of the Town of Calhan to contact the Corps of Engineers before implementing any recommendation in a water of the U.S..

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GLOSSARY OF TERMS

- CHANNEL - A natural or artificial water course of perceptible extent with definite banks to confine and conduct continuously or periodically flowing water. Channel flow is that water which is flowing within the limits of the defined channel.
- FLOOD - Water from river, stream, water course, lake or other body of standing water, that temporarily overflows the boundaries within which it is ordinarily confined.
- FLOOD CREST - The maximum stage or elevation reached by the waters of a flood at a given location.
- FLOOD FREQUENCY - A means of expressing the probability of flood occurrences as determined from statistical analysis of representative stream flow or rainfall and runoff records. The frequency of a particular stage or discharge is usually expressed as occurring once in a specified number of years. The 10-, 50-, 100-, and 500-year frequency floods have an average frequency of occurrence in the order of once in the number of years indicated.
- FLOOD HAZARD AREAS - Areas susceptible to flood damage.
- FLOOD PEAK - The highest stage or discharge attained during a flood event; also referred to as peak stage or peak discharge.
- FLOOD PLAIN - The relatively flat or lowland area adjoining a river, stream, watercourse, lake, or other body of water which has been or may be covered temporarily by flood water. For administrative purposes the flood plain may be defined as the area that would be inundated by the 100-year flood.
- LEFT or RIGHT STREAM BANK - The left or right bank of the stream looking downstream.
- PERCHED CHANNEL FLOW - A condition where the flow elevation in the outer portions of the flood plain is higher than the flow elevation in the main channel. This condition occurs when a secondary channel receives inflow from some location upstream and maintains a flatter slope than the main channel.
- REACH - A hydraulic engineering term used to describe longitudinal segments of a stream or river.
- RUNOFF - That part of precipitation, as well as any other flow contributions, which appears in surface streams of either perennial or intermittent form.
- STREAM - Any natural channel or depression through which water flows whether continuously, or intermittently, including

modification of the natural channel or depression.

STRUCTURE - Anything constructed or erected, the use of which requires a more or less permanent location on or in the ground. Includes but is not limited to bridges, buildings, canals, dams, ditches, diversions, irrigation systems, pumps, pipelines, railroads, roads, sewage disposal systems, underground conduits, water supply systems and wells.

VALLEY CROSS SECTION - A plotting of the topography of a stream channel and adjoining landscape as viewed perpendicular to the flow in a downstream direction. The plotting represents a specified location within a designated stream reach.

WATER SURFACE PROFILE (or FLOOD PROFILE) - A graph showing the longitudinal relationship of the water surface elevation of a flood event to location along a stream or river.

WATERSHED - A drainage basin or area which contributes to runoff and transmits its usually by means of streams tributaries to the outlet of the basin.

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TOWN OF CALHAN FLOOD PLAIN MANAGEMENT STUDY

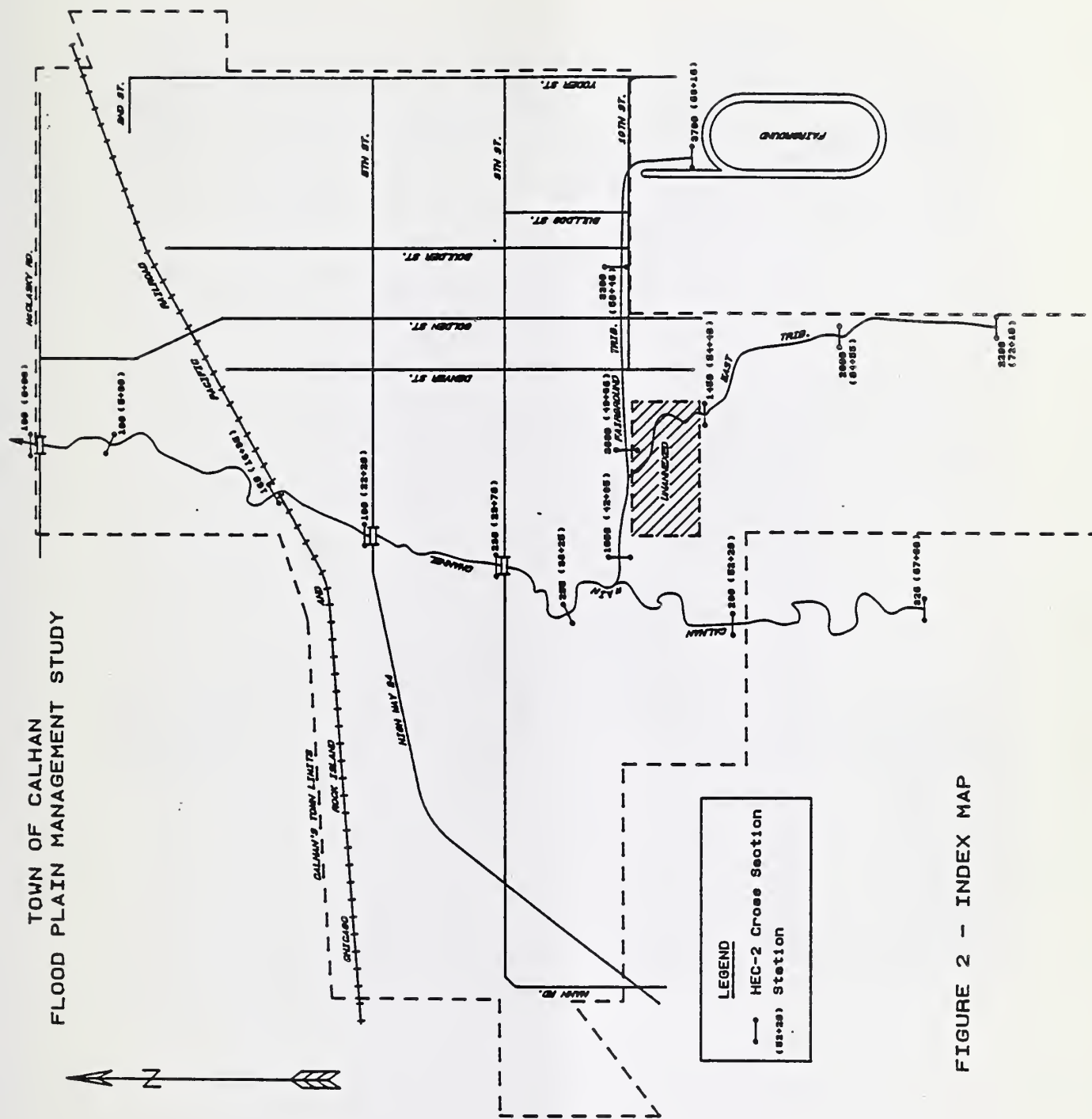
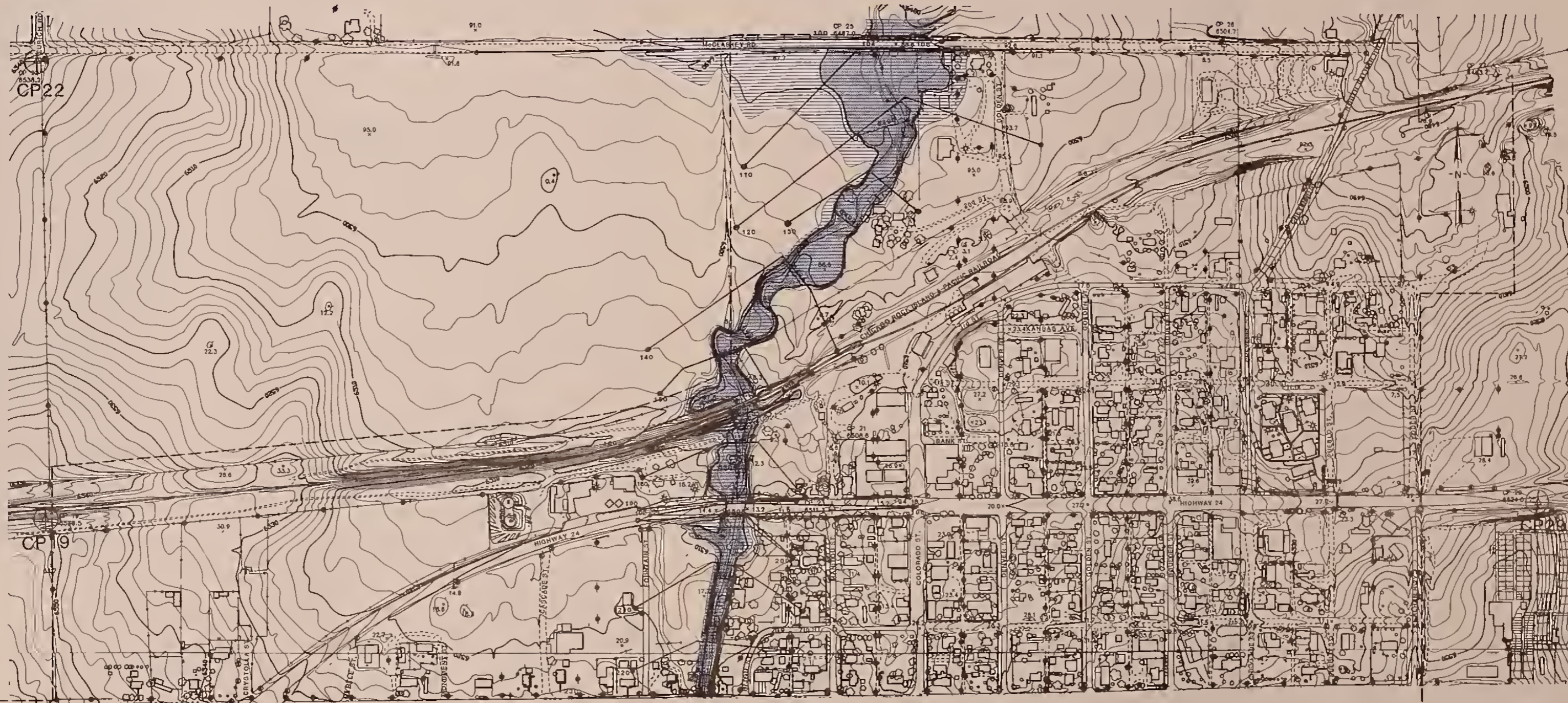



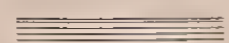


FIGURE 2 - INDEX MAP





TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY TAKEN MARCH 4, 1993. THE MAPS WERE PREPARED FOR THE TOWN OF CALHAN IN COOPERATION WITH THE COLORADO WATER CONSERVATION BOARD, DENVER, COLORADO.

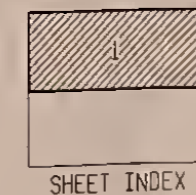
VERTICAL CONTROL WAS BASED ON USC & GS SEA LEVEL DATUM ORIGINATING AT (USC & GS AND/OR USGS) BENCH MARKS L-24 AND 19JH 1988. ADJUSTMENT BEING 6553.763 AND 6597.957

CROSS SECTION DATA WAS HAND PICKED BY THE N.R.C.S.
THESE MAPS COMPLY WITH NATIONAL MAP ACCURACY STANDARDS.

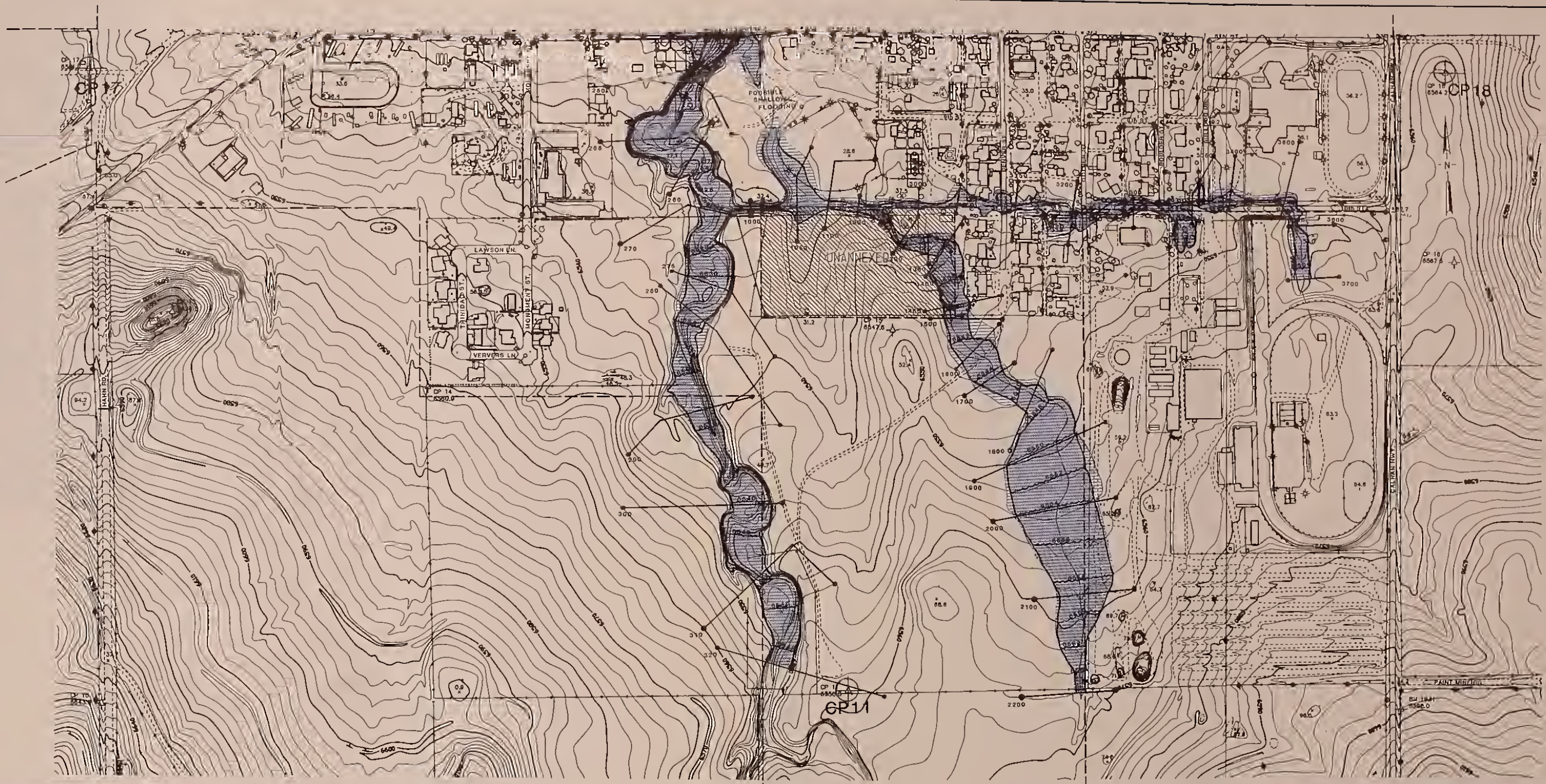
-  100-YEAR FLOOD BOUNDARY
-  500-YEAR FLOOD BOUNDARY
-  100-YEAR FLOOD ELEVATION
-  TOWN LIMITS

-  CROSS SECTION
-  STREAM CENTERLINE AND STATION IN 100 FT FROM LOWER STUDY LIMIT

200 0 200 400
SCALE IN FEET
MAP CONTOUR INTERVAL = 2 FT




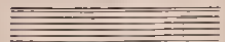
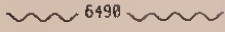

FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF CALHAN
EL PASO COUNTY
COLORADO
SHEET 1 OF 2





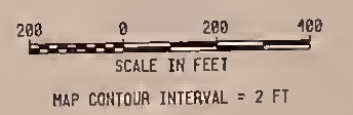
TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY TAKEN MARCH 4, 1993. THE MAPS WERE PREPARED FOR THE TOWN OF CALHAN IN COOPERATION WITH THE COLORADO WATER CONSERVATION BOARD, DENVER, COLORADO.

VERTICAL CONTROL WAS BASED ON USC & GS SEA LEVEL DATUM ORIGINATING AT (USC & GS AND/OR USGS) BENCH MARKS L-24 AND 19JH 1988, ADJUSTMENT BEING 6553.763 AND 6597.957

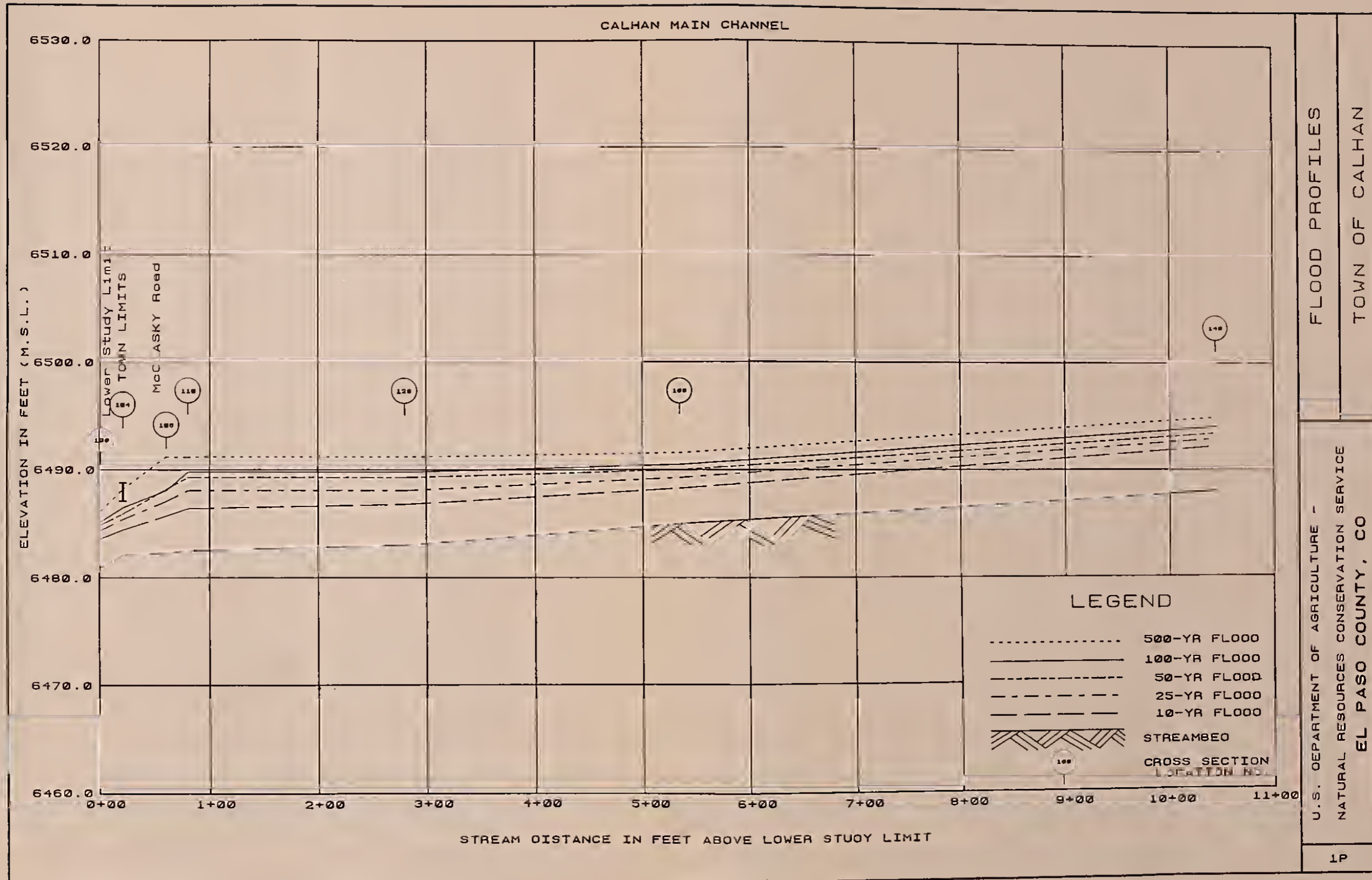
CROSS SECTION DATA WAS HAND PICKED BY THE N.R.C.S. THESE MAPS COMPLY WITH NATIONAL MAP ACCURACY STANDARDS.

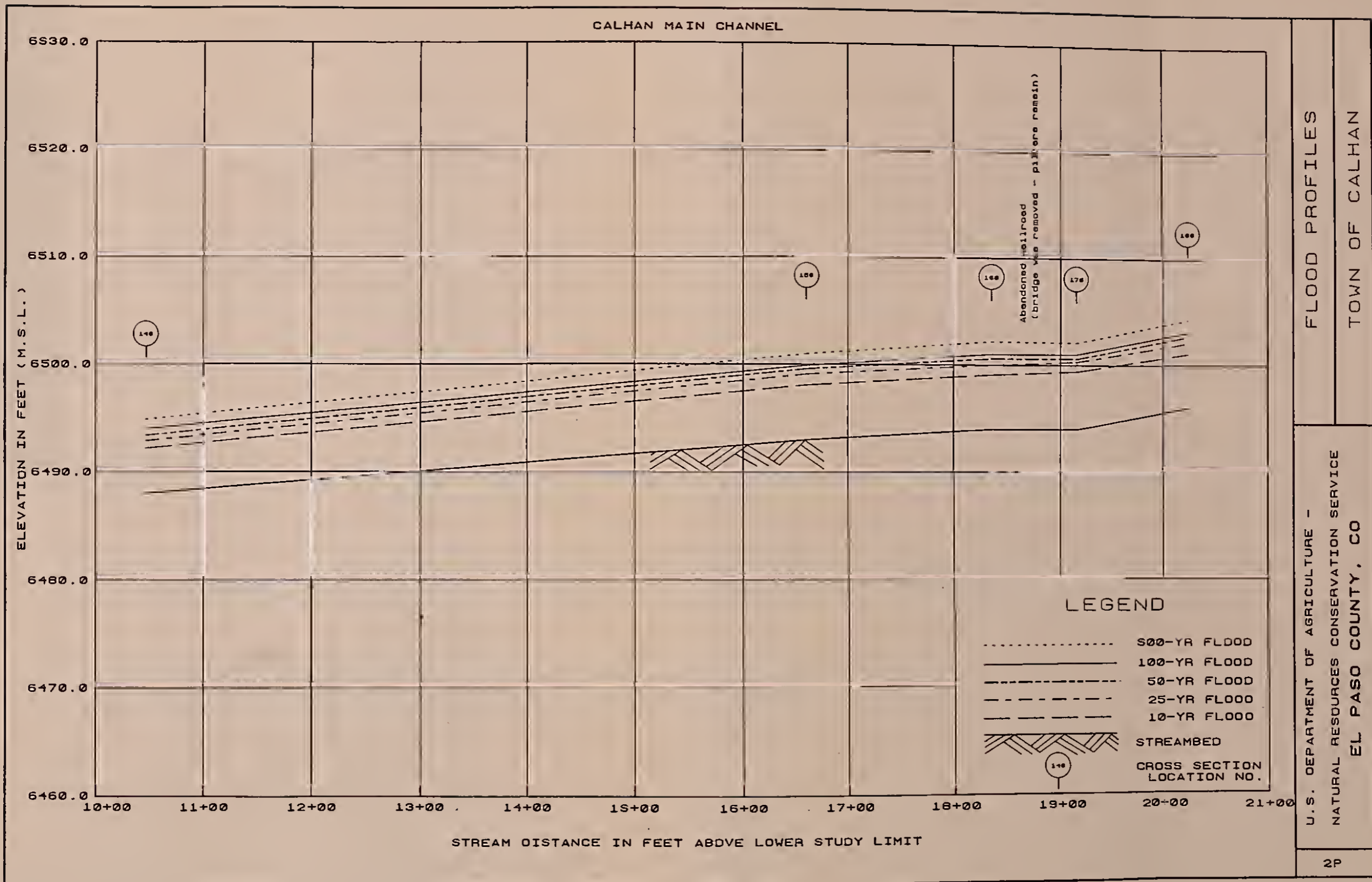
-  100-YEAR FLOOD BOUNDARY
-  500-YEAR FLOOD BOUNDARY
-  6490 100-YEAR FLOOD ELEVATION
-  TOWN LIMITS

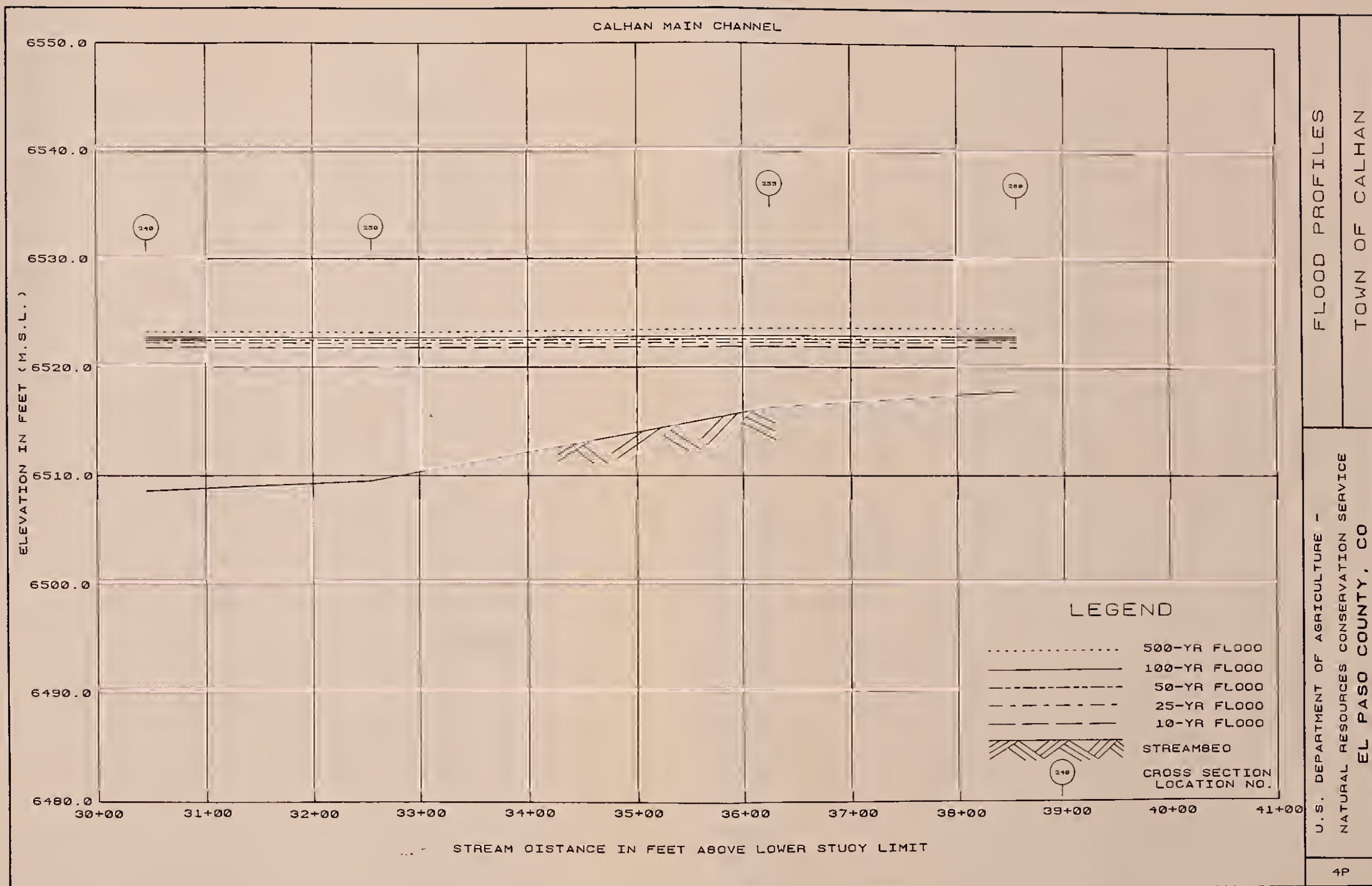
-  CROSS SECTION
-  12
STREAM CENTERLINE AND STATION IN 100 FT FROM LOWER STUDY LIMIT

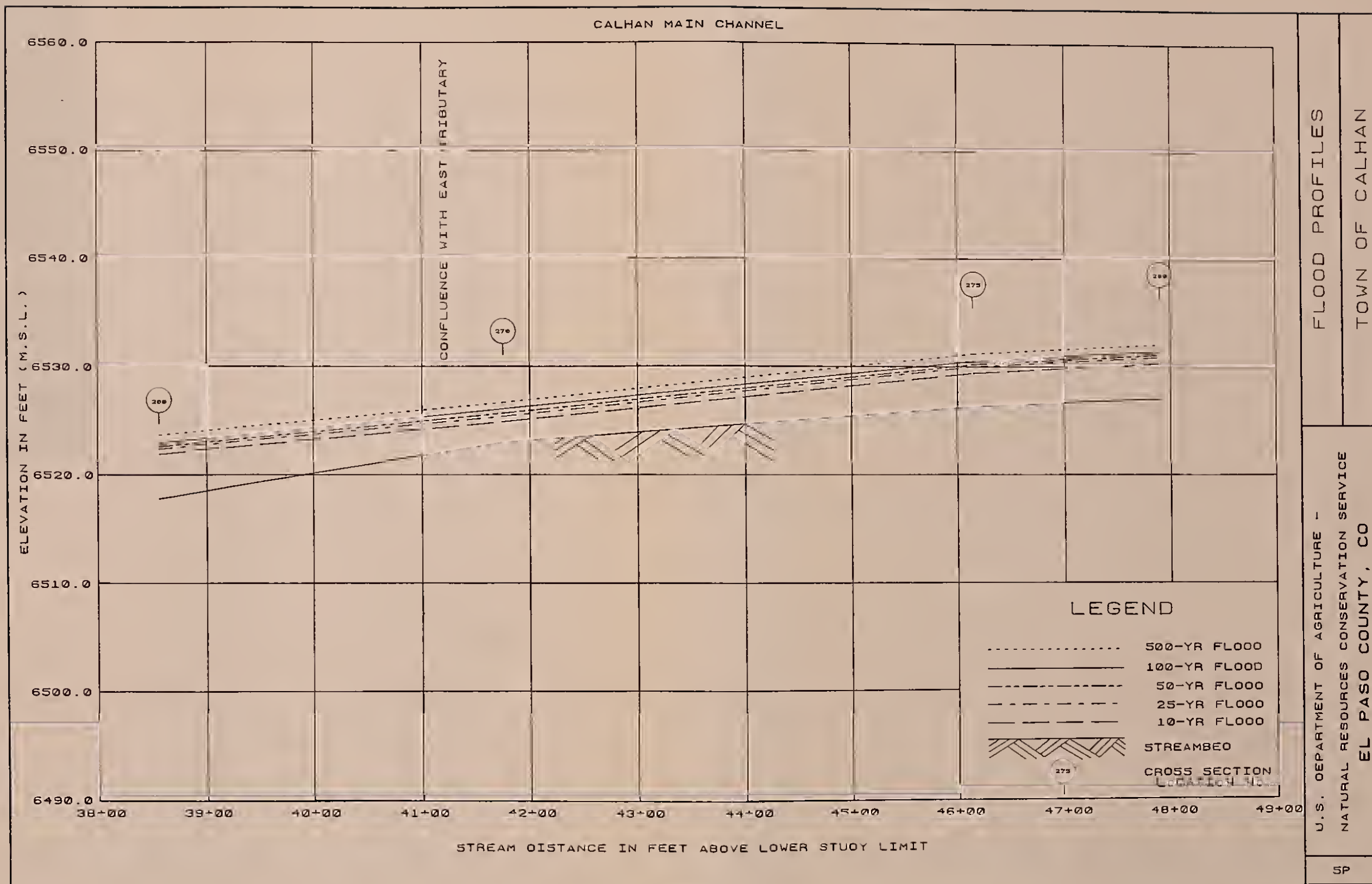


FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF CALHAN
EL PASO COUNTY
COLORADO
SHEET 2 OF 2

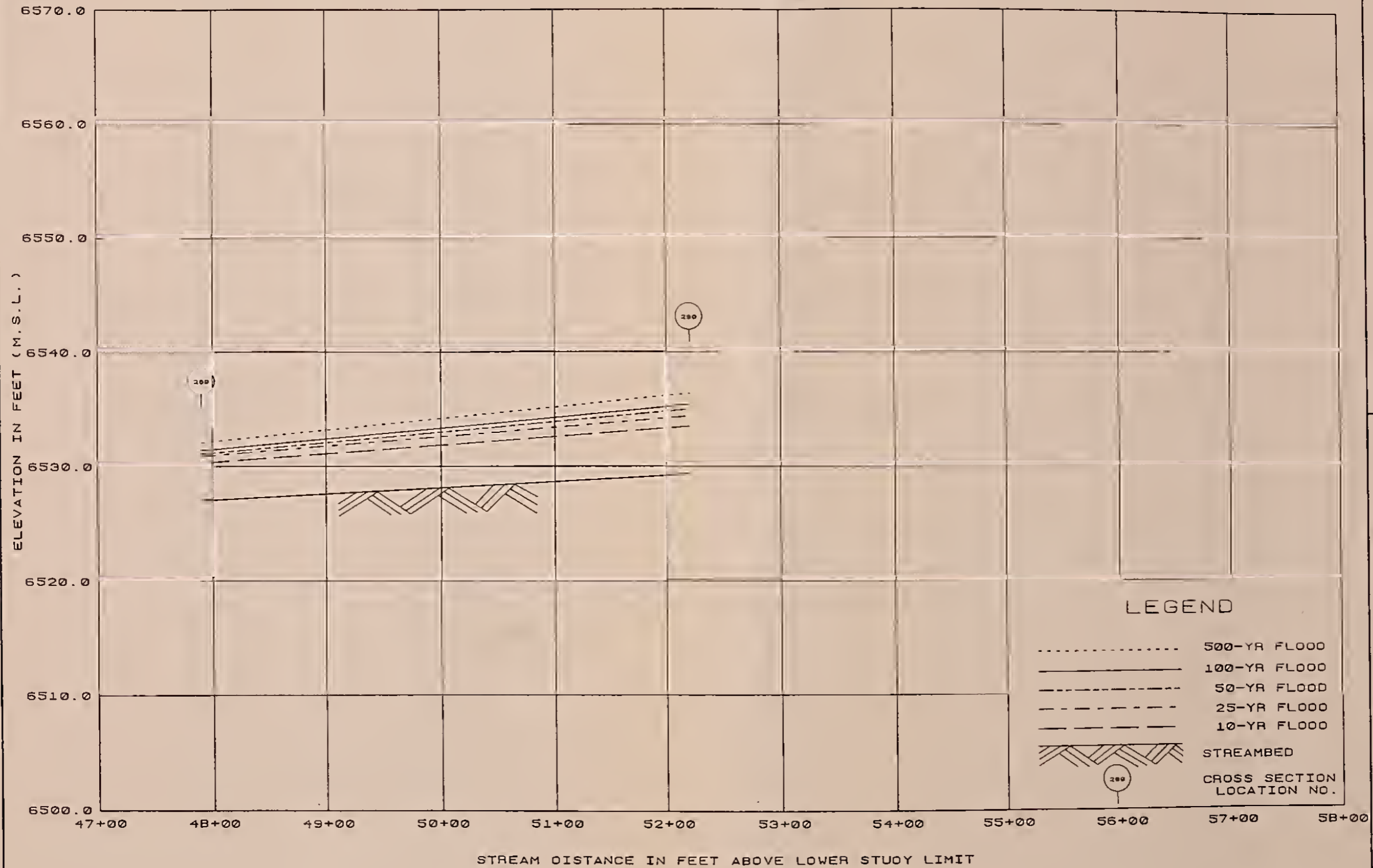






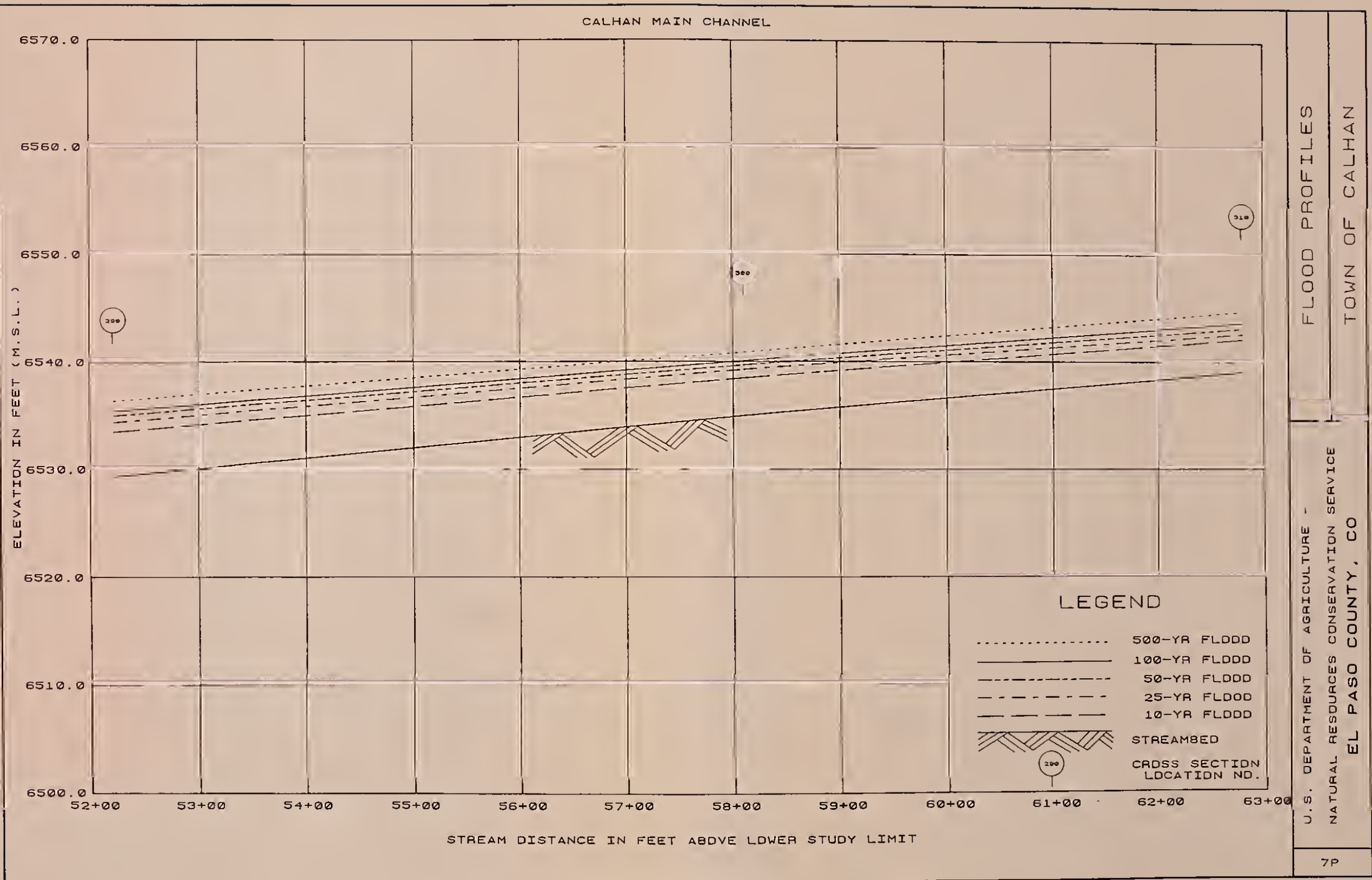


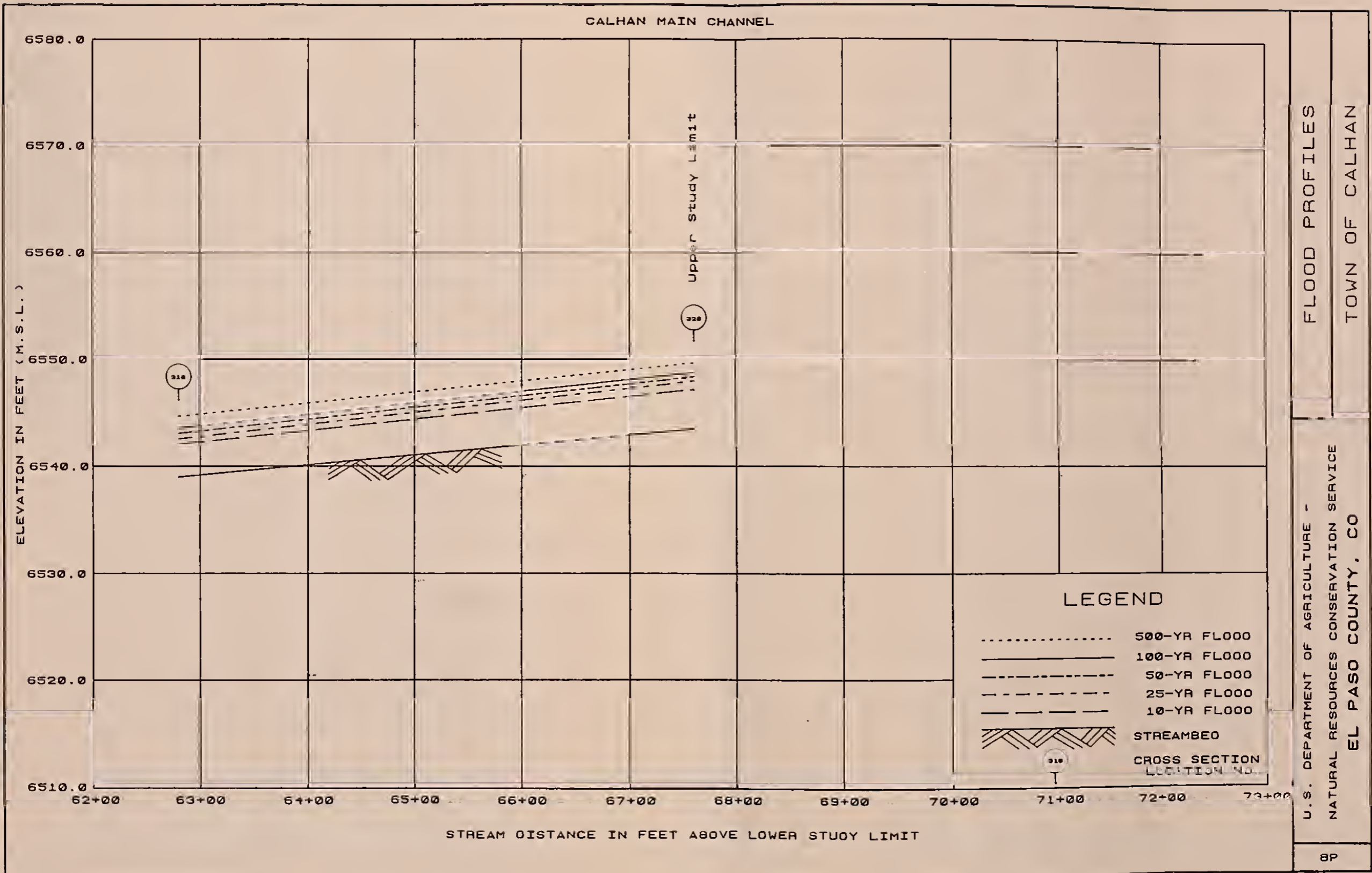
CALHAN MAIN CHANNEL

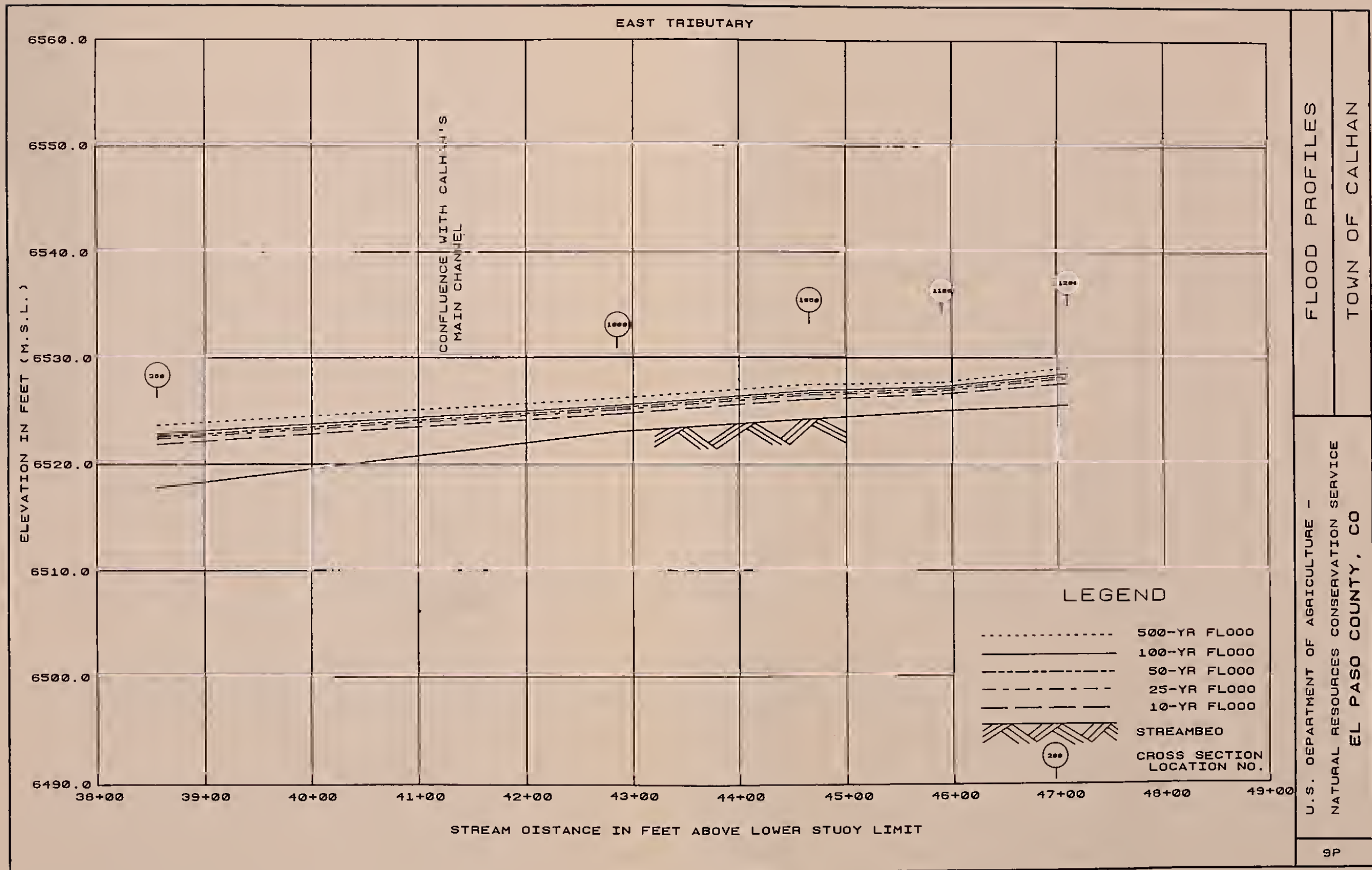


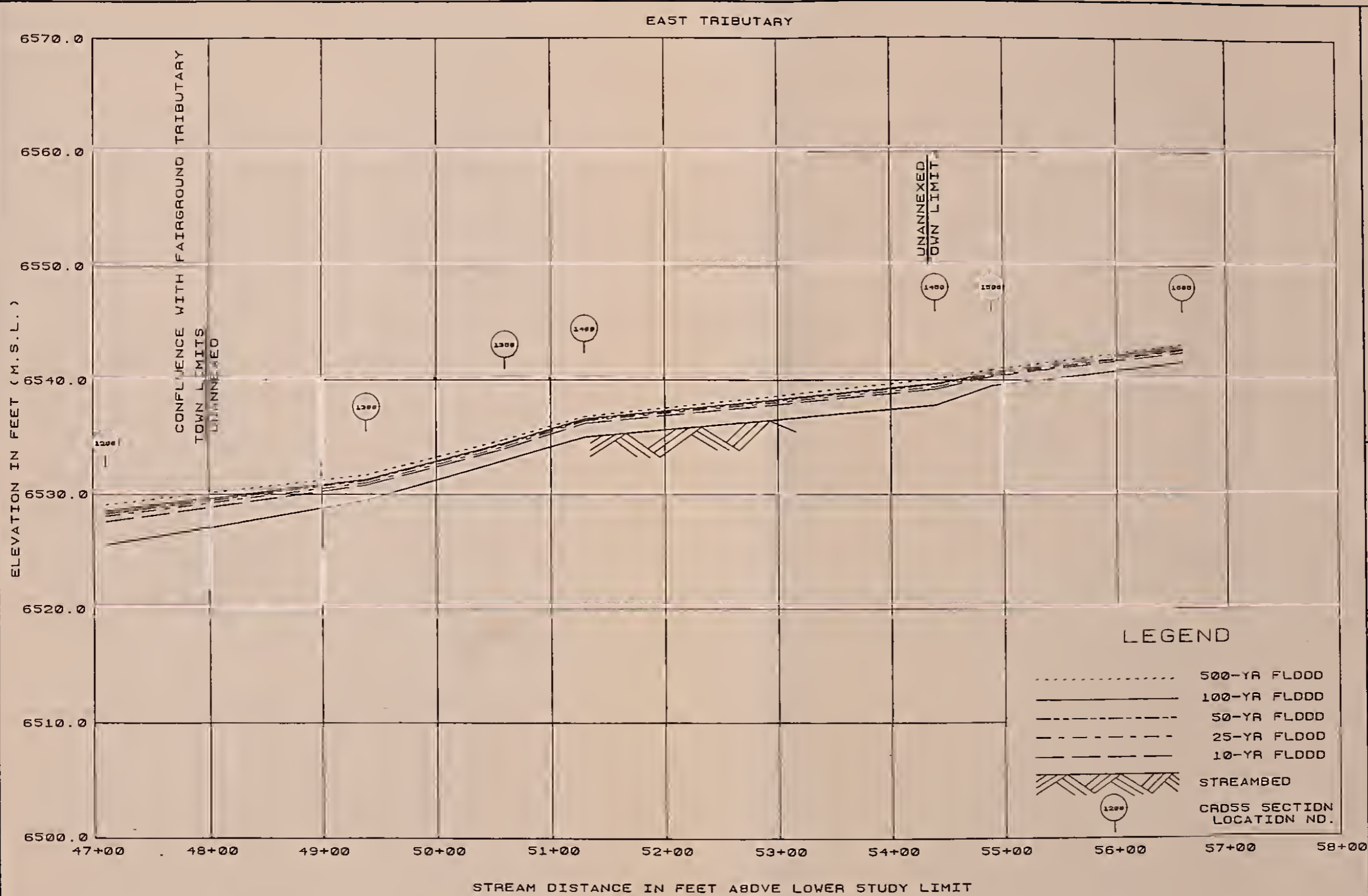
FLOOD PROFILES
TOWN OF CALHAN

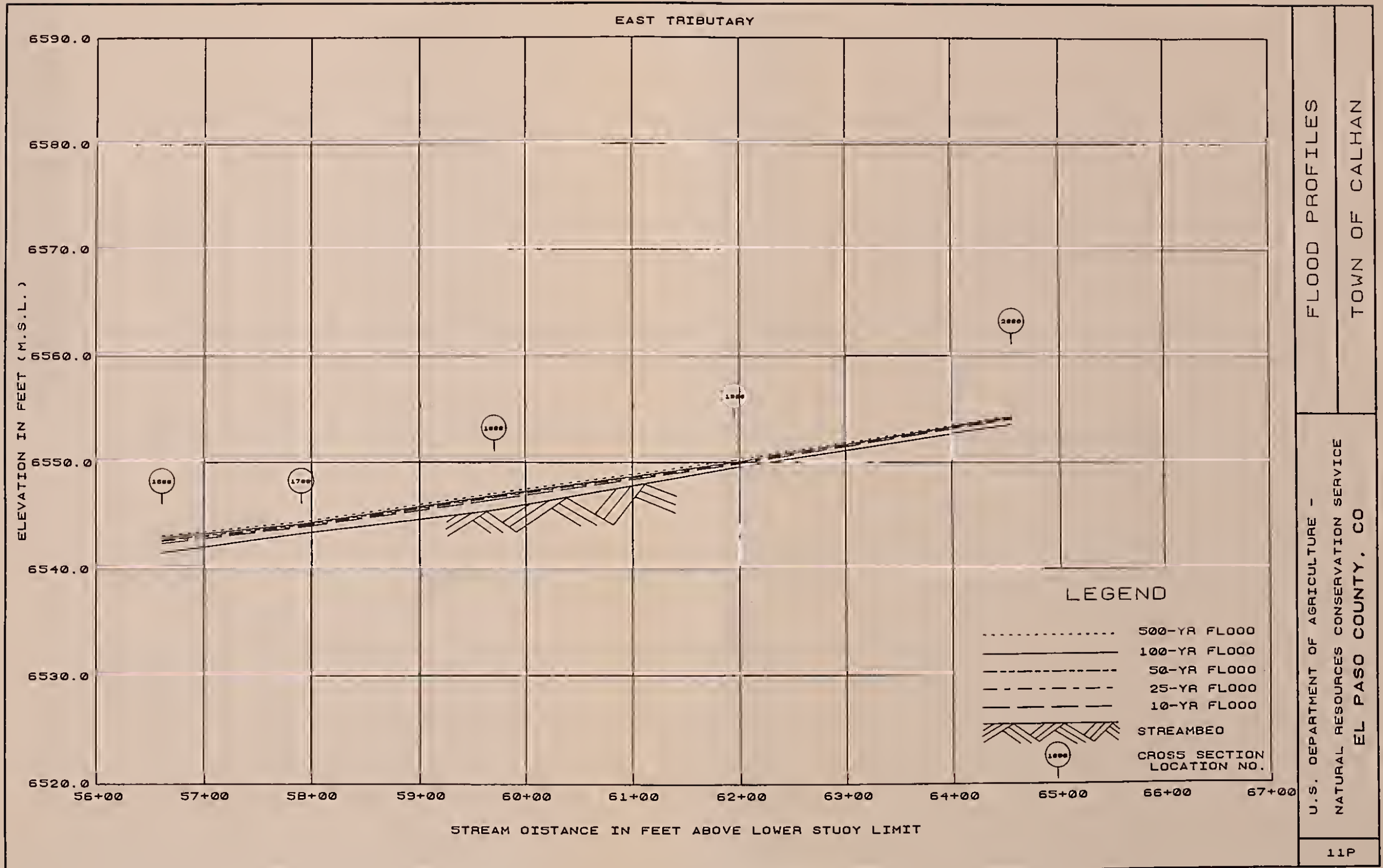
U.S. DEPARTMENT OF AGRICULTURE -
NATURAL RESOURCES CONSERVATION SERVICE
EL PASO COUNTY, CO

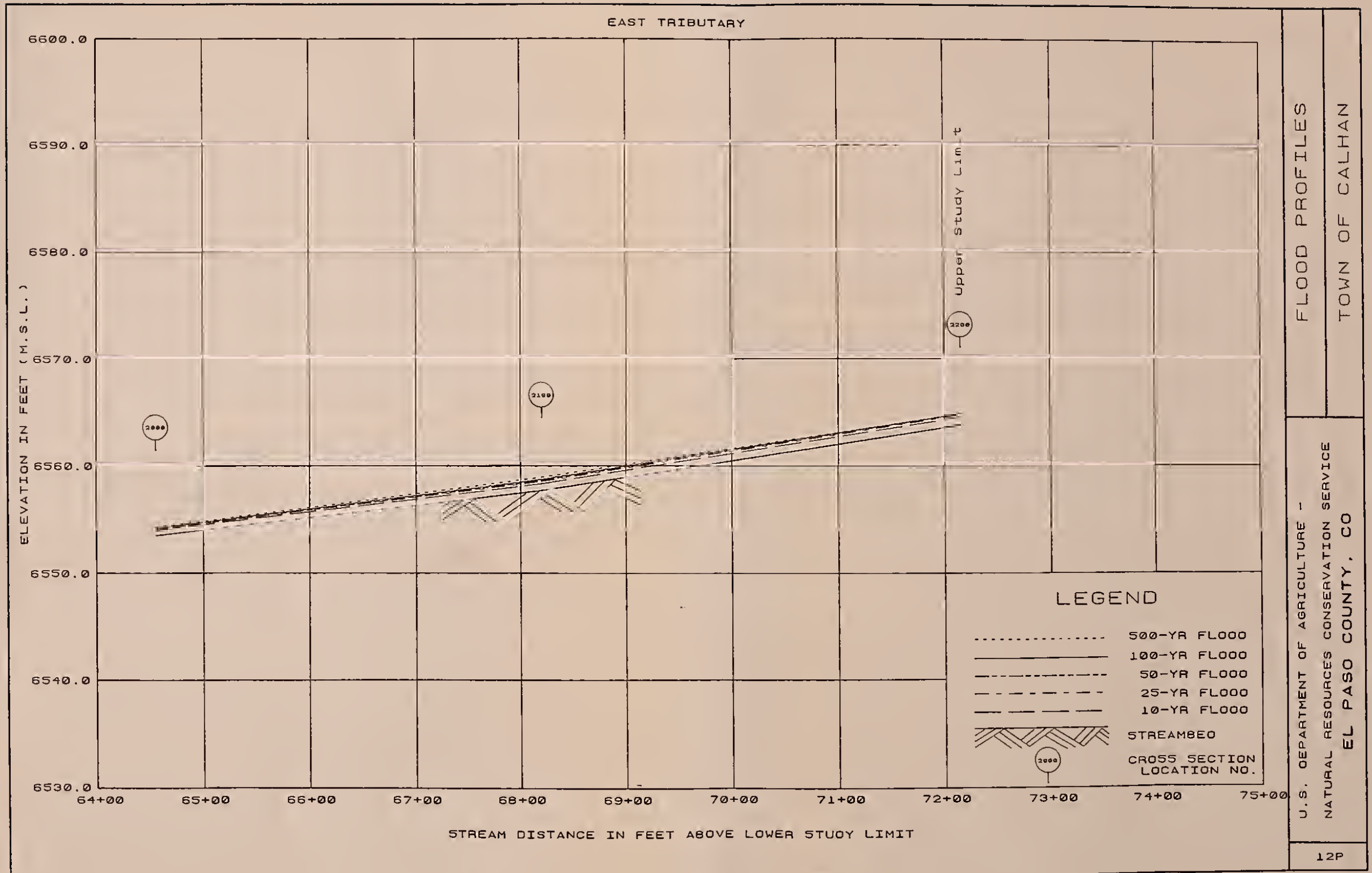


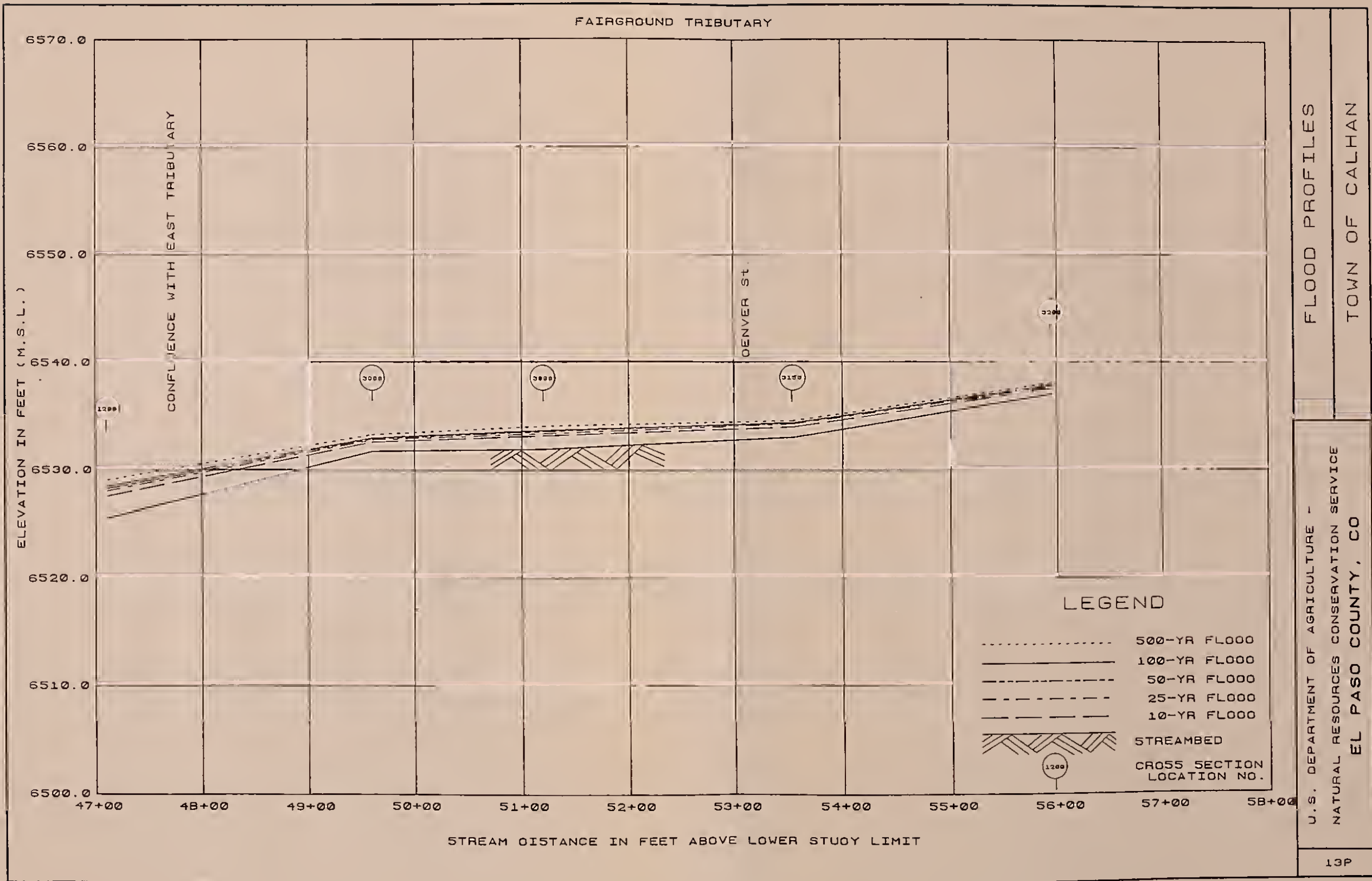


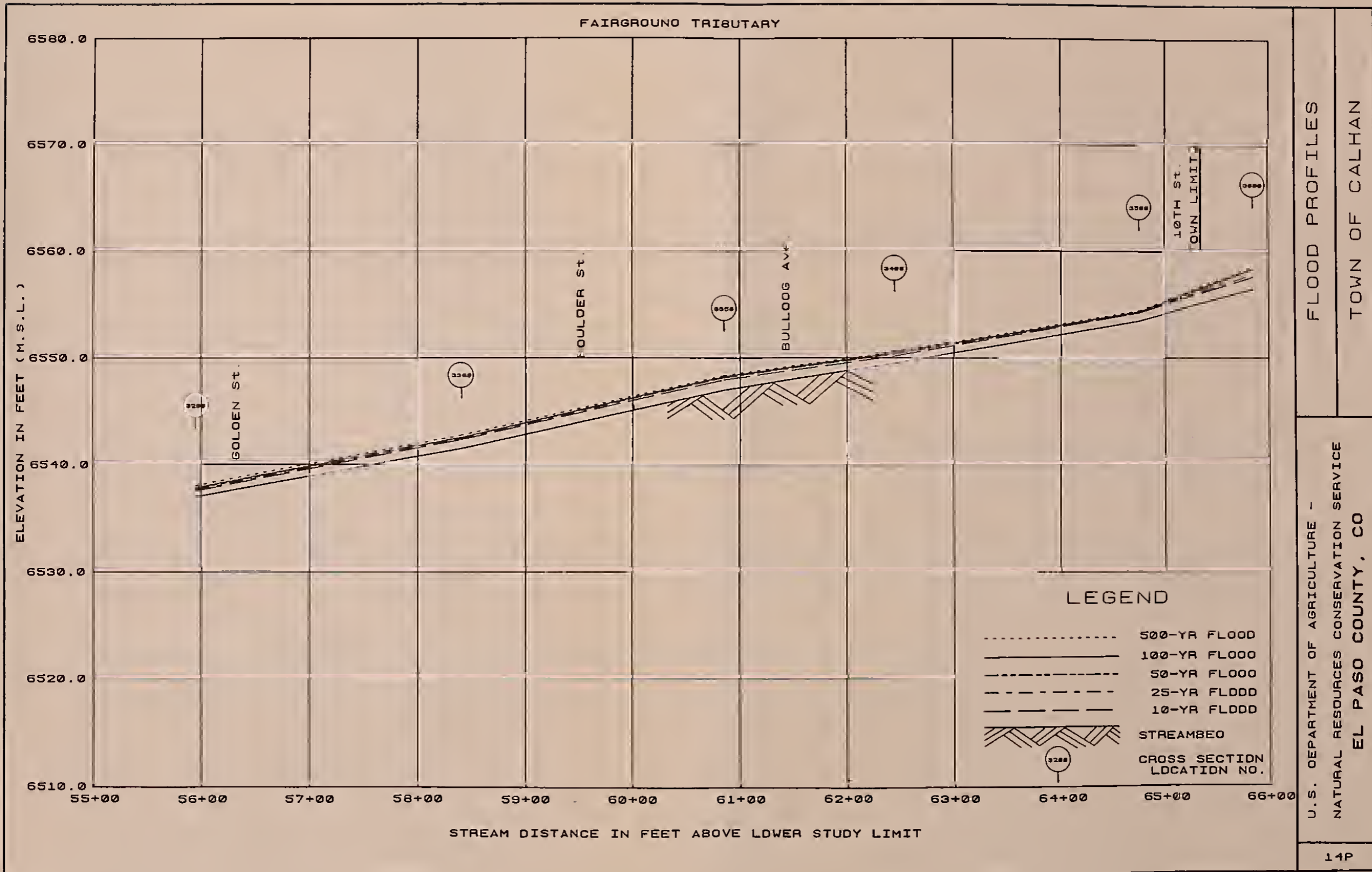




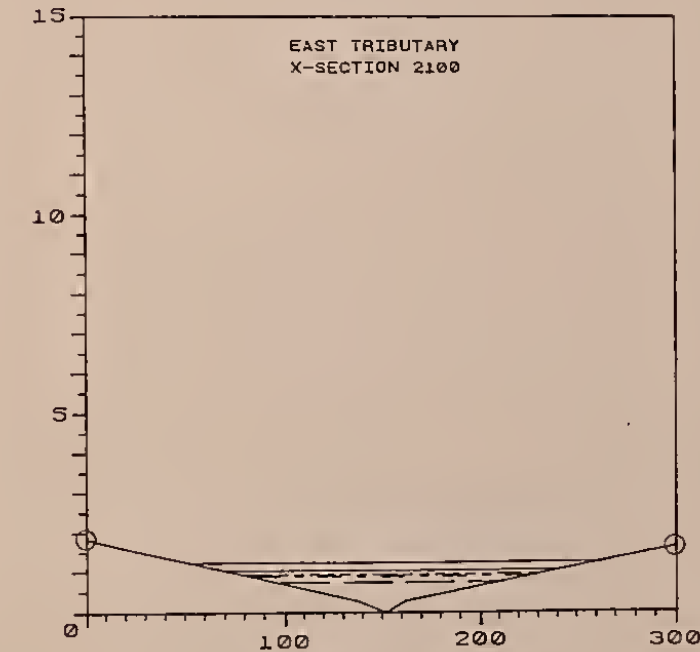
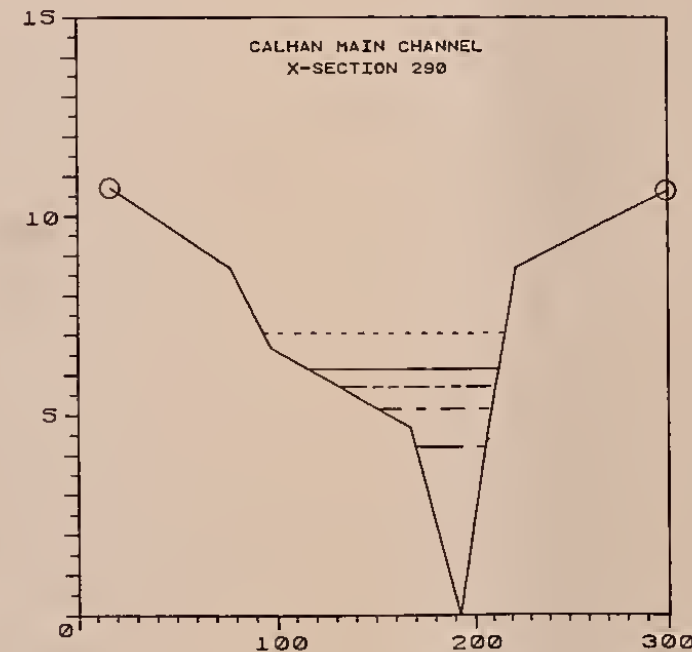
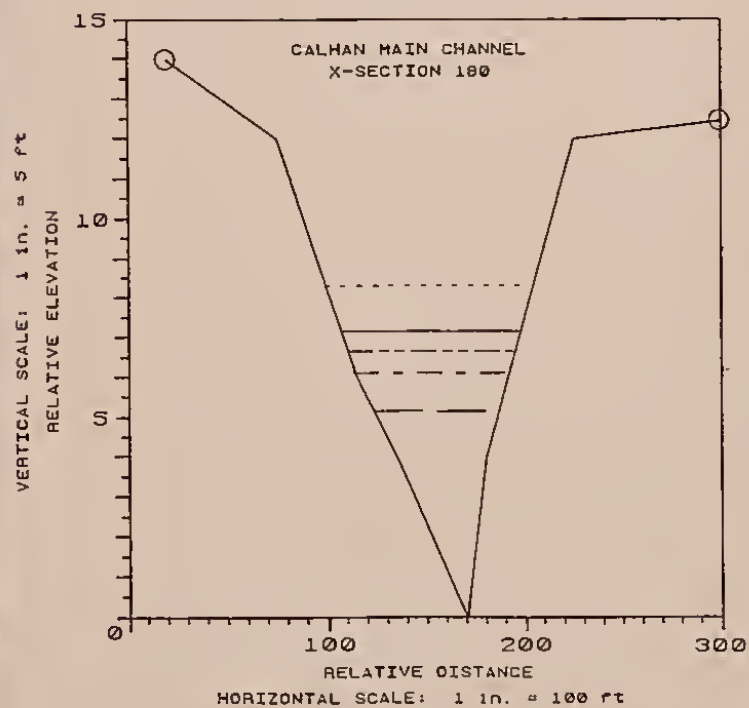
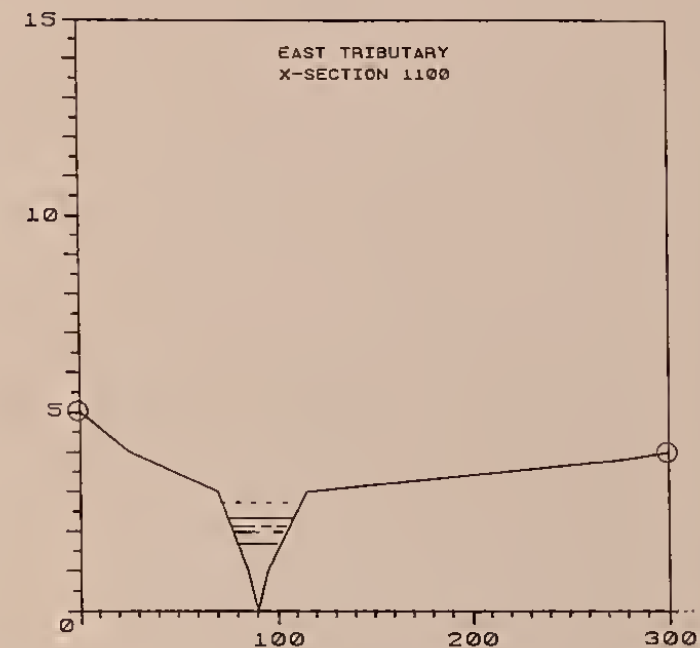
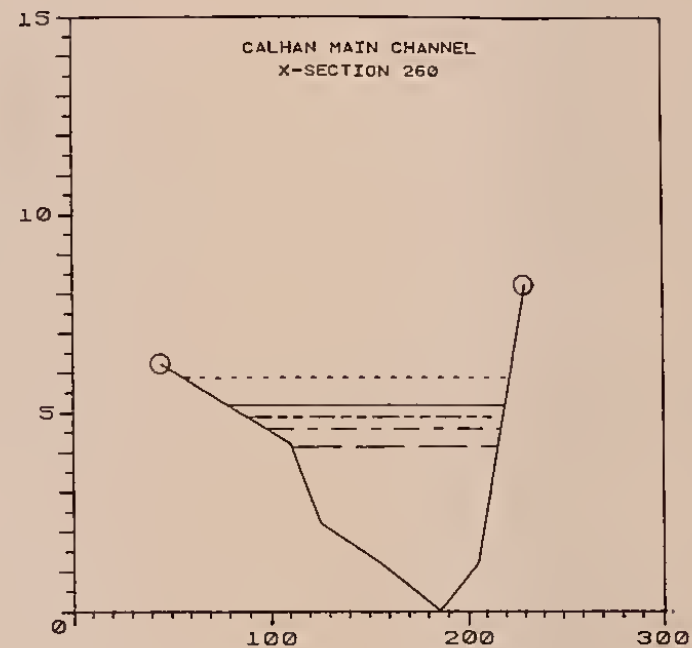
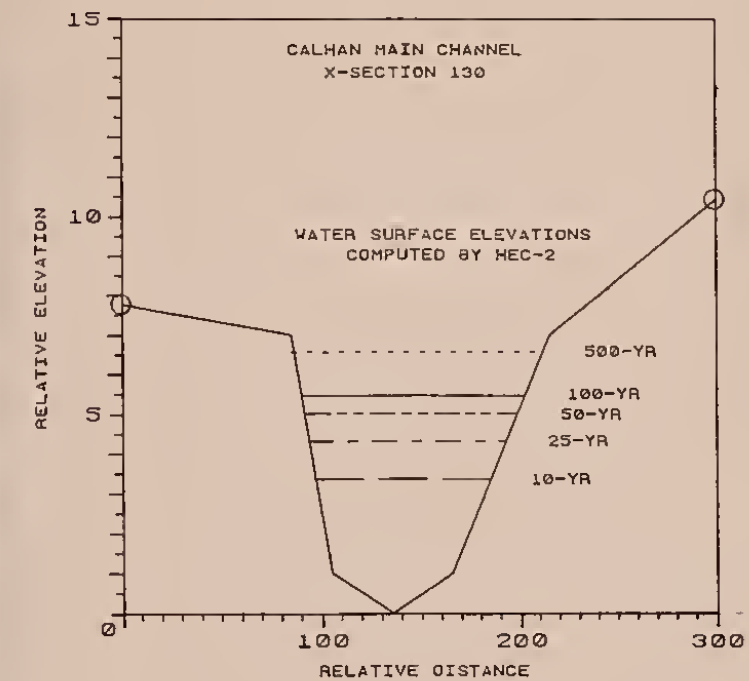


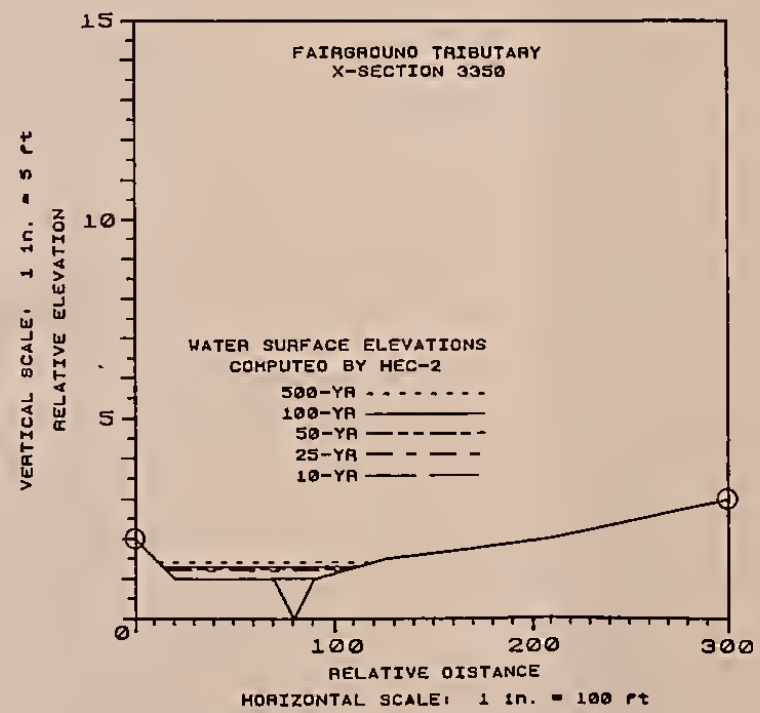
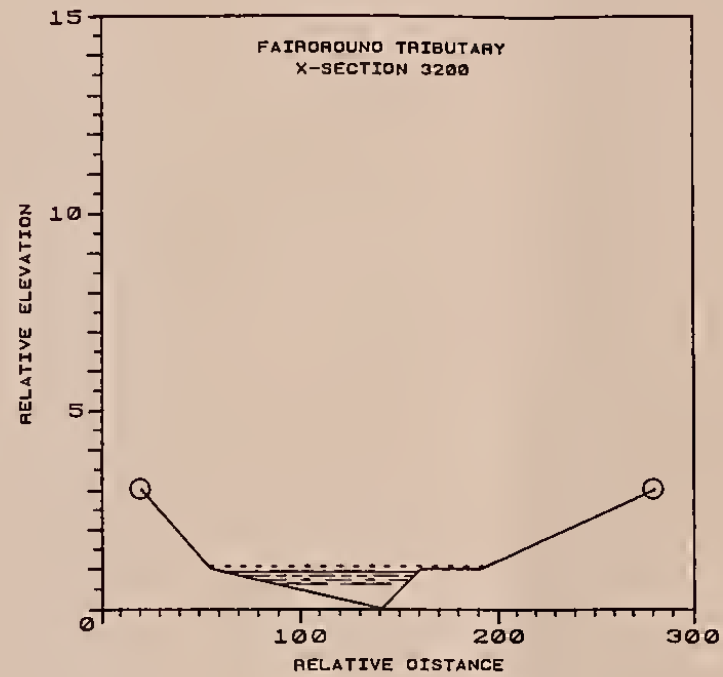












CHANNEL CROSS-SECTIONS

TOWN OF CALHAN

U.S. DEPARTMENT OF AGRICULTURE -
NATURAL RESOURCES CONSERVATION SERVICE
EL PASO COUNTY, CO

2X

TABLE 1: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA

PROJECT: TOWN OF CALHAN FPMS

X-SECT. ID	REACH LENGTH (ft)	STATION DIST. (ft)	STREAM BOTTOM ELEV.	10-YEAR FREQ FLOOD ELEV. (cfs)	25-YEAR FREQ FLOOD ELEV. (cfs)	50-YEAR FREQ FLOOD ELEV. (cfs)	100-YEAR FREQ FLOOD ELEV. (cfs)	500-YEAR FREQ FLOOD ELEV. (cfs)					
CALHAN MAIN CHANNEL													
100.0	0	0	6481.0	6483.60	706	6484.38	1173	6484.86	1508	6485.24	1862	6486.16	2980
104.0	20	20	6482.1	6484.42	706	6485.37	1173	6485.95	1508	6486.53	1862	6488.18	2980
106.0	40	60	6482.3	6485.72	706	6487.10	1173	6488.17	1508	6488.10	1862	6491.18	2980
110.0	20	80	6482.5	6486.41	706	6488.07	1173	6489.25	1508	6489.80	1862	6491.22	2980
120.0	200	280	6483.0	6486.76	706	6488.14	1173	6489.29	1508	6489.83	1862	6491.24	2980
130.0	255	535	6485.0	6488.33	706	6489.32	1173	6490.00	1508	6490.47	1862	6491.57	2980
140.0	510	1045	6488.0	6492.21	706	6492.94	1173	6493.45	1508	6493.98	1862	6494.90	2980
150.0	615	1660	6493.0	6498.12	706	6499.10	1173	6499.56	1508	6499.93	1862	6500.98	2980
160.0	175	1835	6494.0	6499.05	706	6500.03	1173	6500.57	1508	6501.04	1862	6502.23	2980
170.0	80	1915	6494.0	6499.35	706	6500.27	1173	6500.61	1508	6500.98	1862	6502.05	2980
180.0	110	2025	6496.0	6501.14	587	6502.10	976	6502.67	1255	6503.15	1556	6504.30	2506
190.0	195	2220	6499.8	6502.99	587	6503.87	976	6504.37	1255	6504.84	1556	6506.06	2506
192.0	30	2250	6500.1	6503.57	587	6504.37	976	6504.84	1255	6505.29	1556	6506.48	2506
194.0	10	2260	6500.2	6503.82	587	6504.63	976	6505.09	1255	6505.51	1556	6506.57	2506
196.0	40	2300	6500.4	6504.02	587	6504.84	976	6505.32	1255	6505.76	1556	6506.87	2506
198.0	10	2310	6500.5	6504.10	587	6504.98	976	6505.51	1255	6506.00	1556	6507.31	2506
200.0	40	2350	6500.7	6504.37	587	6505.26	976	6505.79	1255	6506.29	1556	6507.64	2506
210.0	140	2490	6501.5	6505.63	587	6506.48	976	6506.95	1255	6507.39	1556	6508.50	2506
220.0	300	2790	6503.8	6508.53	587	6509.48	976	6510.06	1255	6510.60	1556	6512.02	2506
230.0	180	2970	6506.5	6510.60	587	6511.54	976	6512.10	1255	6512.65	1556	6514.08	2506
232.0	20	2990	6507.2	6510.71	587	6511.70	976	6512.39	1255	6513.09	1556	6514.98	2506
234.0	35	3025	6508.5	6521.29	587	6521.70	976	6521.88	1255	6522.00	1556	6522.48	2506
240.0	20	3045	6508.6	6521.83	587	6522.25	976	6522.50	1255	6522.76	1556	6523.30	2506
250.0	210	3255	6509.5	6521.82	491	6522.24	817	6522.48	1052	6522.73	1305	6523.24	2105
255.0	370	3625	6515.3	6521.87	491	6522.34	817	6522.64	1052	6522.94	1305	6523.65	2105
260.0	230	3855	6517.8	6521.88	491	6522.35	817	6522.65	1052	6522.95	1305	6523.67	2105
270.0	320	4175	6523.0	6524.93	491	6525.43	817	6525.74	1052	6526.06	1305	6526.67	2105
275.0	440	4615	6526.3	6529.43	491	6529.96	817	6530.23	1052	6530.49	1305	6531.21	2105
280.0	175	4790	6527.0	6530.30	491	6530.86	817	6531.15	1052	6531.43	1305	6532.11	2105
290.0	430	5220	6529.3	6533.48	491	6534.43	817	6535.01	1052	6535.43	1305	6536.36	2105

TABLE 1: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA
(continued)

PROJECT: TOWN OF CALHAN FPMs

X-SECT. ID	REACH LENGTH (ft)	STATION DIST. (ft)	STREAM BOTTOM ELEV.	10-YEAR FREQ FLOOD ELEV. (cfs)	25-YEAR FREQ FLOOD ELEV. (cfs)	50-YEAR FREQ FLOOD ELEV. (cfs)	100-YEAR FREQ FLOOD ELEV. (cfs)	500-YEAR FREQ FLOOD ELEV. (cfs)					
CALHAN MAIN CHANNEL (continued)													
300.0	590	5810	6535.0	6538.52	491	6539.33	817	6539.74	1052	6540.09	1305	6540.91	2105
310.0	470	6280	6539.0	6542.07	491	6542.64	817	6543.11	1052	6543.55	1305	6544.69	2105
320.0	480	6760	6543.5	6547.21	491	6548.02	817	6548.40	1052	6548.77	1305	6549.73	2105

EAST TRIBUTARY

-260.0	230	3855	6517.8	6521.88	71	6522.35	118	6522.65	151	6522.95	186	6523.67	297
1000.0	430	4285	6523.0	6524.66	71	6525.08	118	6525.33	151	6525.54	186	6526.16	297
1050.0	180	4465	6524.2	6526.13	71	6526.50	118	6526.69	151	6526.89	186	6527.48	297
1100.0	125	4590	6525.0	6526.63	71	6526.94	118	6527.12	151	6527.29	186	6527.70	297
1200.0	120	4710	6525.5	6527.61	71	6528.05	118	6528.29	151	6528.51	186	6529.06	297
1300.0	230	4940	6529.5	6530.75	71	6531.03	118	6531.19	151	6531.34	186	6531.71	297
1350.0	120	5060	6533.0	6534.02	71	6534.24	118	6534.36	151	6534.48	186	6534.79	297
1400.0	70	5130	6535.0	6536.19	71	6536.38	118	6536.47	151	6536.55	186	6536.77	297
1450.0	310	5440	6537.8	6539.17	71	6539.44	118	6539.58	151	6539.73	186	6540.05	297
1500.0	50	5490	6539.5	6540.26	71	6540.43	118	6540.53	151	6540.62	186	6540.85	297
1600.0	170	5660	6541.5	6542.43	71	6542.63	118	6542.74	151	6542.85	186	6543.11	297
1700.0	130	5790	6543.3	6543.88	71	6544.02	118	6544.10	151	6544.17	186	6544.37	297
1800.0	180	5970	6545.5	6546.52	71	6546.71	118	6546.80	151	6546.90	186	6547.14	297
1900.0	225	6195	6549.5	6549.83	71	6549.92	118	6549.98	151	6550.03	186	6550.16	297
2000.0	260	6455	6553.5	6554.01	71	6554.09	118	6554.13	151	6554.17	186	6554.29	297
2100.0	365	6820	6557.7	6558.43	71	6558.59	118	6558.67	151	6558.75	186	6558.96	297
2200.0	395	7215	6563.8	6564.65	71	6564.79	118	6564.87	151	6564.95	186	6564.87	297

FAIRGROUND TRIBUTARY

-1200.0	120	4710	6525.5	6527.61	20	6528.05	34	6528.29	44	6528.51	55	6529.06	88
3000.0	250	4960	6531.7	6532.60	20	6532.80	34	6532.93	44	6533.04	55	6533.31	88
3100.0	160	5120	6531.9	6533.16	20	6533.44	34	6533.59	44	6533.74	55	6534.08	88
3150.0	235	5355	6533.0	6534.04	20	6534.28	34	6534.36	44	6534.42	55	6534.56	88
3200.0	240	5595	6537.0	6537.59	20	6537.72	34	6537.81	44	6537.88	55	6538.07	88
3300.0	245	5840	6541.5	6542.36	20	6542.50	34	6542.58	44	6542.65	55	6542.81	88
3350.0	245	6085	6547.0	6548.00	20	6548.19	34	6548.24	44	6548.28	55	6548.41	88

TABLE 1: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA
(continued)


PROJECT: TOWN OF CALHAN FPMS

X-SECT. ID	REACH LENGTH (ft)	STATION DIST. (ft)	STREAM BOTTOM ELEV.	10-YEAR FREQ FLOOD ELEV. (cfs)	25-YEAR FREQ FLOOD ELEV. (cfs)	50-YEAR FREQ FLOOD ELEV. (cfs)	100-YEAR FREQ FLOOD ELEV. (cfs)	500-YEAR FREQ FLOOD ELEV. (cfs)					
FAIRGROUND TRIBUTARY (continued)													
3400.0	160	6245	6549.5	6550.23	20	6550.35	34	6550.42	44	6550.48	55	6550.62	88
3500.0	230	6475	6553.5	6554.26	20	6554.37	34	6554.43	44	6554.37	55	6554.62	88
3600.0	110	6585	6556.5	6557.67	20	6557.92	34	6558.22	44	6558.43	55	6558.49	88
3700.0	225	6810	6559.4	6560.11	20	6560.28	34	6560.38	44	6560.44	55	6560.70	88



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